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Trends In Dental Research*

Basil G. Bibby, Ph.D., D.M.D.†

The best way of getting myself talking is to begin on a personal plane and relate some of my experiences in research in the United States. In 1930, I received an appointment to the School of Medicine and Dentistry in Rochester. On arrival I found that I was the first dentist to come into the place for, although the Medical School had been opened seven years previously, the plans for having a School of Dentistry had been abandoned.

The original plan had been to set up a School of Medicine and Dentistry, where dentists would be trained on a more scientific plane than had been possible in the past, especially by placing strong emphasis on the basic sciences. Thus the authorities at the University hoped to bring about a revolution in dentistry similar to that which had taken place in medicine as the result of the greatly expanded scientific training programme of the Johns Hopkins University Medical School. As perhaps you know, the Johns Hopkins Medical School under the leadership of William Welsh and William Osler became the institution which over a period of about 25 years turned out most of the teachers for the leading American medical schools. So the Faculty at Rochester, themselves Johns Hopkins men, hoped that by setting up such a scientific school for dentists they could set in motion the same sort of revolution in dentistry. A revolution which would give the same stimulus towards scientific development in the field of dentistry as had occurred in medicine.

The plan was to begin this combined School of Medicine and Dentistry with medical and dental students who had had exactly the same premedical or predental training. That meant that the dental students, like the medical students, would have to spend three or more years in a university college of arts and science before they entered this new combined school of Medicine and Dentistry. Thereafter, the medical and dental students were to take the same courses of instruction in the basic sciences, such as physiology and pathology, but when at the end of the second year the medical students proceeded to Strong Memorial Hospital (the University hospital) for their clinical training, the dental students would go to the Eastman Dental Dispensary (the Institution of which I am now the Director) for their training in the clinical phases of dentistry.

For various reasons the programme in dentistry did not get underway. One reason was that a dental faculty was never assembled. The Dean of the School of Medicine and Dentistry tried to organize the science departments on the basis of a professor, who would carry out research of interest to medicine, and an associate professor, who would carry out a research project which would have a more direct application to the field of dentistry. The professor was to orient the medical students towards the basic scientific problems of medicine and the dental associate professor was to do the same thing for dentistry. The Medical School looked around and, I believe, made a serious effort to find dentists who could do scientific research of the same calibre as that being carried out by the medical staff, but it could not find anyone who could match its scientific pace. Not only were there no dentists with such qualifications, but there were no physicians or science graduates who had carried out research in fields related to dentistry. It should be mentioned here that non-dentist scientists would have been acceptable, for in the United States and in particular the school about which I am speaking, the professors of physiology, biochemistry and so forth are often men with Ph.D. degrees who hold no medical qualifications. The situation was that there were neither dentists trained in scientific procedures nor was there a sufficient body of well integrated scientific knowledge in fields related to dentistry to make it an attractive sphere of research for any non-dentist scientists who could have filled these posts. This made it strikingly apparent that there was a great dearth of scientifically trained dentists, who could use the modern techniques of scientific research and that non-dentists were not challenged by the dental field because there was an insufficient body of modern scientific knowledge in it to make it an attractive field for their investigations. This conclusion was the key to future developments.

The plans of the Dental School also failed for another reason: they failed because they

*An informal discussion delivered at the United Dental Hospital on November 18, 1953, under the aegis of the Faculty of Dentistry, University of Sydney and the Institute of Dental Research. Chairman: N. E. Goldsworthy.

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were too far ahead of their time. In 1923 when the dental training was offered in Rochester, a graduate from an American high school could go to the leading dental schools in the country and in four years could graduate as a doctor of dental surgery. Obviously, therefore, there was no appeal for students in the prospect of spending at least seven years to get a dental degree from an unknown dental school. The result was that very few prospective dental students appeared. After seeking suitable dental students for four or five years the dental programme was suspended.

The experiences just recorded convinced Dean Whipple of the School of Medicine and Dentistry that the greatest need of dentistry was the development of scientifically trained dentists. Therefore a plan was organized for bringing dentists into the Rochester research medical centre and giving them an opportunity to do research and study in the basic medical sciences. It was Dean Whipple's conviction that the best way of developing a man and providing him with an opportunity to learn was to give him a chance to do research. It happened that I drifted into Rochester as the first man to be appointed under this experimental training programme. I was assigned to a laboratory and was told to do some research relating to dentistry. It is rather significant that the first appointee was a New Zealander, since it indicates the lack of interest among members of the dental profession in the United States in these opportunities which at that time had been available for several years.

The philosophy underlying the Rochester scheme was that, if suitable dentists were put into a stimulating scientific atmosphere, they would learn to do research and in the process acquire scientific knowledge. It seemed rather a foolish project to set out to change the scientific emphasis of dentistry from that lonely laboratory. I remember Dean Whipple saying: "This is not a five-year plan — this is a fifty-year plan. In fifty years or so you'll see the results of this experiment; it will influence dentistry just as Johns Hopkins did medicine." Of course, fifty years seemed like rather a long time for a young man to wait for results. The prospects didn't seem very attractive, for there was absolutely no interest in or support for the programme in American dental circles. If anything, there was opposition to this invasion of dentistry by other sciences. To gain perspective in this matter, it must be remembered that at that time there were only one or two textbooks published in America on a scientific aspect of dentistry which came from the pens of American trained dentists. Prinz, Hopewell-Smith, Churchill and such authors all obtained their scientific training in Europe. The Americans had produced many textbooks on the technical basis of dentistry but scarcely any on the scientific side. Because of this somewhat inhospitable climate for dental scientists, there did not seem to be anywhere for the dentists trained in Rochester to go. The first two or three men who spent a year or two with us went out to minor teaching appointments in clinical dentistry. They have now moved from those positions and hold responsible positions on dental faculties where their scientific and research experience can be used. Indeed, the situation has changed so much that today, from the group of about fifty men trained over twenty years in Rochester, seven deanships, some twenty professorships and quite a number of associate professorships have been filled in a dozen or so dental schools.

Gradually, a period arrived when the dental schools began to seek people who could teach the basic dental sciences from a broader background than teachers had had in the past. Previously, the pattern of teaching in dental schools had been that the teacher of dental students was either a person who was not quite good enough to teach the medical students and so was given a try out at teaching dental students, or someone who had grown old in a department and was not useful there anymore. The whole attitude of the dental students reflected that fact. They considered that these subjects taught by such teachers were not worth doing and certainly not worth the serious interest of any red-blooded dental student. The picture changed in the better dental schools as men of some scientific prestige began teaching basic sciences in a more interesting way.

The war gave a strong stimulus to scientific research in dentistry. During the war years industrial concerns had a lot of money to spend and in the United States the tax situation was such that industry could either pay surplus profits tax or plough its money back into its business. Many industries decided this was a good time to get some research done in preparation for post-war markets and so they began expanding research. The possibility of therapeutic dentifrices appeared and fluorine research expanded. Because the cost of overcoming the ravages of dental decay figured so prominently in the national budget, an Institute for Dental Research was formed in Washington as one of the National Institutes of Health. The Army and the Navy also developed dental research departments. As a result of these developments, and within fifteen years from the time the Rochester programme began, the demand for research workers trained in some phase of dental science increased tremen-

dously, and today men who have a broad scientific training and some experience in research are in great demand. To me it is remarkable that such revolutionary changes could occur in a period of twenty years. In that time American dental schools have changed from being antagonistic to basic scientific research to accepting it as a hallmark of respectability and educational stature. Such is the background of the attitude towards dental research in the United States at the present day.

Of course any developments in research depend upon having men who want to do research and on getting them properly started on their research careers. The philosophy of the Dean of Rochester was that, if students or internes work in a research atmosphere, many of them will become interested in doing research and that, when a man wants to do research, he should be given every assistance, and deficiencies in formal training should not prevent anyone from entering the field. In other words he, a leading man in medical research, considered that all that was needed to do research was a curiosity and basic ability. He thought that, if an able dentist wanted to do research and was given the opportunity, he would eventually demonstrate that he could do research as well as those with longer medical or scientific training. It was emphasized that all who want to do research should be treated equally regardless of whether the interest was in dental research or medical research. All types of research were encouraged, but research in clinical fields was regarded as of less importance than basic scientific research. In other words, the pivotal point of research was not medicine but science, and consequently a dentist doing good basic research enjoyed a research and scientific status of the first order. His prestige was second to none. It is interesting to note that some of the dentists who entered basic research at Rochester achieved sufficient distinction in scientific fields, outside the field of dentistry, to have made careers in them and hold responsible supervisory positions in their new fields.

When the industrial organizations which for many years had not thought it scientifically worthwhile to sponsor research in dental schools saw that the quality of the research being done by dentists was improving, they commenced financing research programmes. As an example, one organization has given 20,000 dollars a year for basic research in the field of periodontal disease or dental caries without any restrictions being placed on the method of research or the use of their grant. In other words, when it became apparent that dentists could do good work — when they became of full stature scientifically — then sources of research support began to appear. The Public Health Service noted this development and was able to justify a Dental Research Institute. From the time dentists were able to do experimental investigations of some significance, those in control of research funds began to lose the habit of discrimination against any research project that had the words dental or teeth attached to it; for it had become apparent that important basic scientific principles could be established by research on dental problems. Recently, there have been numerous pieces of work carried out by dentists which have contributed basic findings important in the whole area of medical science, and it is clear that research work done by a dental group can be as good as that by any other.

One is often asked what do those sponsoring research hope to get out of it. There are two or three attitudes toward the purpose of research. There is one which I regard as the "institute" attitude in which the results of the research are the goal: the purpose is to get new information. Well, that needs no justification. Then there is a modification of that position which is found in the armed forces and government sponsored dental research institutes which accept that primary purpose, but take as a secondary goal the perpetuation of their species of investigators. They tend to concentrate more on bringing in the trained men to do the research than on providing training opportunity for the people who want to follow on in that field. Lastly, there is the attitude to which I am most partial which I would describe as the university or teaching purpose of research. Research is regarded as a teaching tool and that by doing research, so a person is taught. The results of the research are regarded as incidental, although as anyone with extensive experience in research will know this approach often pays the largest dividends in results.

In the Department of Dentistry, which combines the University of Rochester and the Eastman Dental Dispensary, the Dental Fellows and staff seek out their own research problems, primarily to satisfy their own curiosity. It is not customary to assign a man a problem. The usual procedure is to say to a new man, "If you want to do research, look around in the laboratories and study in the library and see if you can decide what subject or problem you want to work on and then come and talk to us." A certain number of people, and those are the ones whom I think have real research ability, fairly quickly find out in what field they would like to work. Of course there are those who want an electron microscope and so forth before they begin;

they obviously require a little discouragement. There are others, who in seeking a background for their work will read, read and read and never become completely liberated from what we call the "bondage to the printed word." After a while they are encouraged to become practicing dentists or else they are assigned to work with someone else on a going problem. A certain number of such people take fire at a later stage and settle down to produce something worthwhile on their own. Not all do, however, and it must be remembered that in all educational fields there is much human wastage. This is definitely true of training for research, but no one is the worse for trying.

What can you judge from the research that a man does? What would he get out of it and what would an institution get out of it? I regard research as being more or less a substitute for the formal courses of logic and philosophy that used to be the *sine qua non* for anyone who wished to have the fruits of his mental processes taken seriously; for in order to do research, a man must possess the ability to reason and an ability to retain and correlate information. I think the chance to demonstrate ability in research provides an opportunity to demonstrate very important capacities. A man who can contribute critical thought to a problem in bacteriology or who can see the weaknesses in a bacteriological theory, is to my mind the man who is likely to be able to see the weakness in a technique of making crowns and bridges. This ability indicates an attitude of mind and I think research more than anything else serves to reveal that type of ability. By doing research one realises more quickly than by any other way that there are no real divisions in science. If a man works on a basic problem (for instance, how to differentiate bacteria), he quickly finds that he has to be concerned with basic biochemistry and basic physiology, problems of respiration and problems of nutrition. He finds that the divisions of science and medicine are mere conveniences and that he must learn to integrate all these disciplines in the one problem. I think that chances to demonstrate originality come out of scientific research. So for those reasons I have complete confidence in the wisdom of turning a man loose in the laboratory. If he can do something on his own, then I think he has the qualities we want, either as a research worker, as a teacher or a critical practitioner. Even if he fails to produce any worthwhile work, it is never time wasted.

There are different attitudes toward the value of different types of research. There are some who think that a problem is not worth pursuing unless it is fundamental research. While I believe that such research is of greatest value as an educational experience, I am also a little critical of the person who feels that he has to delve into mystical realms before he is doing real research. To me it scents a little of witchcraft and I resent the superior attitude that such people sometimes take towards those who are doing more routine but nonetheless critical work at a clinical level. I personally think that one of our great needs is critical clinical observation. However, as a laboratory investigator I would also like to make the point that the power of critical observation so necessary in the clinic can be brought out by basic laboratory research. A man who learns to be critical of his bacteriological counts is more likely to be critical of his counts of carious cavities.

There is always a difficulty in trying to apply to clinical practice the knowledge which is produced from basic research and also in directing critical clinical observations on to new problems so that there will be a starting point for fundamental laboratory research which might assist in their elucidation. The Eastman Dental Dispensary (as distinct from the School of Medicine and Dentistry) is trying to meet this difficulty. It is attempting on one hand to serve as an agency which will study clinical problems and then attempt to solve them in the laboratory, and on the other hand, to take the basic information which is obtained from fundamental research and try to make use of it by developing new clinical methods. However, because of our interest in developing an interest in research in young men, our efforts are not concentrated on what we personally feel might be the most profitable areas of investigation, but it is allowed to wander into areas in which our young research workers have enthusiasm.

Without such enthusiasm or faith in his own ability no young man would continue in research. The need of "faith" in research leads logically to a final, somewhat philosophical, thought. That is, that the research worker and religionist are closer together than they realise. One needs to possess a certain amount of the "holy spirit" before devoting one's life to research work. I like to use terminologies, such as Faith, Inspiration and Holy Spirit, regarding research, because I feel that the attributes described by such theological terms have their counterparts in what is too often regarded a field of hard-headed scientific realism. In any case, without pushing this metaphor too far, most of us in research will agree that such material "sacrifices" as a research and teaching career may require, earn their reward in lasting mental and spiritual satisfactions.

Recent Advances in Local Anaesthetic Solutions and Allied Drugs for Use in Dentistry*

B. G. Broadbent, M.D.S. (Syd.)

Introduction.

It is my intention to discuss recent advances in local anaesthetic solutions, and before I begin I must mention that I shall be as dispassionate and unbiased as possible in my personal opinions of drugs, since those I have used myself have not been tested over a sufficient number of cases to be conclusive perhaps to other than myself.

The particular properties of a local anaesthetic solution of interest to a dentist are:

(1) Potency.

(2) Toxicity.

(3) Rapidity of Onset.

(4) Duration.

Many others arise such as tissue irritation, stability, pH, isotonicity, spread, penetration, shelf life and cost. However, with the number of solutions available today, the American Bureau of Dental Standards, and the competition of manufacturers, there will soon be no place on the market for strongly toxic, irritant or unstable solutions, and the variable factors will then remain as potency, onset and duration.

Good local anaesthetic solutions have advanced to the stage where, in normal use, it is not the objective signs which are disturbing, but more the finer, subjective symptoms. This introduces, in critical analyses, an element of the dentist's interpretation of the patient's feelings and so is somewhat unassessable.

Obviously patients' reactions to small volumes of local anaesthetic injections are not all pyschic for some, especially cocaine, do induce feelings varying from the dread to the erotic, others an uneasiness, restlessness or a "sitting on a bomb" feeling. These may not always be associated with very noticeable objective symptoms and have often been disregarded. Their absence is the factor on which the patient will nowadays remark.

I do not consider that there is one panacea. We must choose our solution to match our task and our patient. The recent post-war advances in the production of new drugs are amazing. New local anaesthetic drugs, new vasopressor drugs and new vehicles for their solution are appearing on the market; I do not mean new brands but new drugs and new combinations of drugs. XYLOCAINE has set a standard. In the history of local anaesthesia it stands out as much a milestone as did procaine. To the operator who had fallen back on cocaine for profound local anaesthesia, it was a boon; to the dentist with procaine dermatitis a life saver and to the manufacturers of other drugs, a challenge. It is this challenge, I imagine, which has so furthered the study and production of new drugs.

I would now like to go through those new drugs which have been produced and marketed, and give you a brief resume of each, beginning with new anaesthetics, new vaso-constrictors, and new ideas concerning the vehicle of the drug. Among these are such as XYLOCAINE, UNACAINE, RAVOCAINE, AMETHOCAINE, NORADRENALINE, OENETHYL and VASOPRESSIN.

Xylocaine.

Diethylamino 2-6 dimethylacetanilide or LIDOCAINE is used as the hydrochloride salt. I feel this must be well known to you all by now. The factors I would like to stress are:

1. It can be used without any adrenaline content for those patients who are cardiac risks, thyreo-toxic or adrenaline susceptible. The anaesthesia is fleeting and of use only in short surgical procedures or for very short operative work such as the removal of gingival caries in upper anterior and bicuspid teeth. Two very nervous patients of mine with known hyperactive thyroids have noticed it as a big improvement on XYLOCAINE with adrenaline 1-80,000. Two cases I admit, are not at all conclusive but the patients showed considerable unrest after the injection of normal XYLOCAINE 1-80,000 adrenaline, and remarked on the difference in effect without knowing it was a different solution.

   I have used XYLOCAINE without adrenaline in quite a few cases where I particularly wanted my patient to have only a transitory anaesthesia of 15 to 20 minutes. It makes one realise the ability of the circulation to remove or absorb injected fluids. Pulpal anaesthesia is definitely obtainable. By this I mean anaesthesia sufficient for pulp extirpation if needed. Larger volumes than usual and accurate techniques are required. I found that a labial or buccal

* Read at the 13th Australian Dental Congress, Brisbane, June, 1953.

infiltration of 2 ml. was needed for pulpal anaesthesia in the maxilla and 3 ml. mandibular blocks.

2. XYLOCAINE can be used topically.

3. It is compatible with penicillin and the sulphonamides.

I would like to emphasise that probably we can all use smaller volumes than we do at the moment. Half the usual 2 per cent. procaine volume is normally adequate. XYLOCAINE has the doubtful fault of being such a potent and diffusing anaesthetic, that the operator with poor technique can still achieve good results. After all, the less solution injected the better despite a low toxicity. XYLOCAINE is available with adrenaline 1-80,000 or 1-100,000 for routine use or 1-50,000 for surgery and with no adrenaline for specific avoidance of the toxic effects of adrenaline.

XYLOCAINE is also recently available with NORADRENALINE. Compared with 2 per cent. procaine, 2 per cent. XYLOCAINE has a longer duration, a greater spread, quicker onset, is three times more profound, there are no reports of sensitivity to it, is compatible with penicillin and sulphonamides, is good topically and has a 40 per cent. greater toxicity on a gramme for gramme basis but is less toxic than the required amount of procaine for the same task.

UNACAINE.

2 iso-butyl aminoethylmeta amine benzoate hydrochloride, is a newly synthesised drug recently released in America by the NOVOCOL manufacturers.

Archer speaks of UNACAINE as more potent than 2 per cent. MONOCAINE or 4 per cent. procaine, but giving a shorter duration. It is not as liable to produce a dermatitis as the amino benzoic acid group is in the meta and not the para position on the benzene ring.

In one report of 1000 cases used for conservative work onset was two minutes or less to produce a profound pulpal anaesthesia. It had a short duration and was twice as effective, gramme for gramme, as procaine, with a toxicity (in white mice) five times less.

In another report of 3667 cases 97.5 per cent. were claimed as non toxic and in 2.5 per cent. mild toxic signs from sweating to nausea and fainting were seen. Onset in infiltration injections was immediate and block anaesthesia developed in from 90 to 120 seconds usually. Duration was generally shorter than 2 per cent. procaine but when anaesthesia disappeared it did not wane but went swiftly.

A third report of 2280 cases stated that it gave 94.7 per cent. profound anaesthesia, 4.9 per cent. fair and 0.8 per cent. poor; 1.8 per cent. produced a mild toxicity with fainting, nausea and trepidation; 99.5 per cent. were post-operatively normal. There was seldom need for a repeat injection. It is a highly diffusible solution with 2-c.c. for a mandibular block, including both lingual and long buccal nerves with a duration of an hour. Also profound anaesthesia was possible by infiltration for all lower incisors and bicuspids.

The makers claim that it is two and a half times more potent and much less toxic than procaine unless injected intravenously, when it is of equal toxicity. It has been used in 5,000,000 dental injections and the incidence of pallor, trepidation, fainting has been lower than similar studies with MONOCAINE or procaine; the potency exceeds 2 per cent. MONOCAINE or 4 per cent. procaine, and gives an average duration of one and a half hours for surgery and one hour for operative procedures; there are no allergies and it is compatible with penicillin.

UNACAINE is made up in 3.8 per cent. solutions with 1-60,000 adrenaline—has a slight yellowish colour and I believe a shorter shelf life than procaine.

I have used UNACAINE for a series of 60 cases. It is not commercially available in Australia yet. The solution used was 3.8 per cent. with an adrenaline content of 1-60,000 in 1.8 c.c. cartridges. Short case histories were kept. I had no serious toxic or post-operative effects and consider that its onset is, if anything, quicker than XYLOCAINE and the duration of pulpal anaesthesia much shorter; usually about 40 minutes. The penetration and spread in soft tissue did not seem as great as with XYLOCAINE but the tendency for slight pain on injection, sometimes noticed with XYLOCAINE, was not seen. I felt it was excellent for operative procedures due to its almost immediate onset and its duration lasting so little after their completion. We naturally hope that our patients leave the surgery in an improved state and not, if after having one filling done, with half their face numbed for two hours.

In one patient a bilateral comparison was carried out to test the duration; 1.8 c.c. of UNACAINE given as a buccal infiltration for an upper first molar produced an immediate pulpal anaesthesia with a soft tissue effect lasting 80 minutes whereas 2 c.c. of XYLOCAINE with *no* vaso-constrictor at all lasted 90 minutes. The same patient, when I used procaine, PONTOCAINE and NORADRENALINE solutions complained of symptoms of numbness seven hours later.

In most cases a 1.8 c.c. cartridge was ample for a mandibular block and 1 c.c. for maxillary anterior teeth. I found that pulpal anaesthesia had developed by the time it was needed without delay, the patient being allowed a rinse and perhaps a minute's respite before any operative work was attempted. It is not an anaesthetic which permits you to see another patient pending the onset of anaesthesia. I discovered on several occasions, when I deliberately delayed to enable me to test the duration of pulpal anaesthesia, that with my longer tasks such as multiple restorations I had run out of time. Once pulpal anaesthesia was established I had 30 minutes certain time, sometimes an hour but no longer before the changes from no pulpal to no soft tissue anaesthesia occurred.

Therefore, with UNACAINE 3.8 per cent. 1-60,000 adrenaline we have a remarkably quick onset, potent, short duration anaesthetic solution well suited for operative work. UNACAINE is an isomer of MONOCAINE, the difference only being that the amino benzoic acid group is attached to the benzene ring in the meta and not para position. This it is hoped will account for no allergies or anti-sulphonamide action which the procaine, PONTOCAINE, MONOCAINE, BUTYN group are heir to with their common paraamino benzoic acid grouping.

AMETHOCAINE.

Tetracaine hydrochloride, is known also as DECICAINE, PANTOCAINE, PONTOCAINE, BUTETHANOL or DIKAINE. It is parabutylamino benzoyldimethylaminoethanol hydrochloride. The structural formula allies the drug to procaine as a paraamino benzoic acid drug hence liable to allergies and anti-sulphonamide action.

We, in dentistry, come across it in N.P.C. in combination with procaine and COBEFRIN, PONTOCAINE is an acknowledged toxic drug and is not recommended for injection in over 0.15 per cent. concentration. Its addition to 2 per cent. procaine is adding to the toxicity, duration and potency of the solution.

We have all possibly tried this combination. I have found it very good but have seldom used large volumes and have no complaint on its toxicity. Good comparative blind tests have shown it to possess an increased toxicity and to be an undoubtedly more potent solution than without the PONTOCAINE. I myself prefer it to 4 per cent. procaine. Quite recently it has been marketed by an Australian firm in Melbourne as 2 per cent. procaine, 0.15 per cent. AMETHOCAINE, and 1-50,000 NORADRENALINE. I will discuss the NORADRENALINE later on but it would appear to me to be a step ahead of COBEFRIN. I have used the solution for approximately 100 patients and watched very closely for side effects but have observed none. I have compared it with 2 per cent. XYLOCAINE 1-80,000 adrenaline in bilateral mandibular blocks and could only see a difference in onset time, the XYLOCAINE being quicker.

PONTOCAINE is not recommended alone for dental use except as a topical surface anaesthetic. In combination with procaine and NORADRENALINE or COBEFRIN, it has use as a long lasting (two hours) potent anaesthetic, useful for such tasks as jacket crown preparation or surgical procedures.

Volumes required for injection are higher than XYLOCAINE but slightly less than 2 per cent. procaine.

Higher Concentrations of Procaine.

The higher concentrations of procaine were frowned on for quite a while by the American Dental Association Bureau of Standards until overwhelming evidence of the lack of serious procaine toxicity was furnished. This is seen in the intravenous use of procaine, amongst other things, as an analgesic in certain cases of intractable pain in terminal cancers.

Clinically I find that 4 per cent. procaine produces a quite noticeably higher incidence of restlessness, perspiration and tremor than 2 per cent. This is still very slight compared to 1 per cent. cocaine but is present especially if over 2 c.c. is used. I see little need for its use when 2 per cent. XYLOCAINE is available.

Brands of procaine in higher concentrations than 2 per cent. are available in Australia, from 2.15 per cent., 2.25 per cent., 3 per cent. and PHARMATONIN 4 per cent. with vasopressin which I will discuss later. One writer has used up to and higher than 6 per cent. solutions of procaine with no adrenaline where adrenaline's toxicity was to be avoided. He and many others refute the geometric progression of toxicity of procaine. It is a vaso-dilator and therefore the effect of the higher concentrations without adrenaline is still more fleeting. There seems no need in dentistry for procaine without adrenaline. Increasing concentrations of adrenaline strength will not produce an equal potency available with the more recent drugs.

RAVOCAINE.

2-diethyl amino-ethyl 4 amino 2 propoxy-benzoate hydrochloride is obtained by the addition of a 2 propoxy group to the procaine molecule. This drug was recently synthesised by Sterling Winthrop and has just (February, 1953) been placed on the U.S. market as a local anaesthetic in conjunction with procaine

and COBEFRIN or procaine and NORADRENALINE (LEVOPHED). It is a somewhat similar arrangement to N.P.C., but a claim is made for greater potency, shorter duration and quicker onset.

RAVOCAINE by itself is claimed to be nine times as potent as procaine and to be active in concentration as low as 0.06 per cent. The commercially available solution is 2 per cent. procaine, 0.4 per cent. RAVOCAINE with a choice of vaso-constrictors 1-10,000 COBEFRIN or possibly 1-30,000 NORADRENALINE (called LEVOPHED).

Onset time is claimed as immediate or at least below two minutes. Its duration is much shorter than N.P.C. All final symptoms have disappeared in two and a half hours, pulpal anaesthesia having disappeared well before. I have used a small quantity of the COBEFRIN-containing solution on approximately 50 patients. The supply house told me that it has been released in U.S.A. only a matter of weeks and the package flown to me was marked as "under investigational use." I notice no toxic side effects, no post-operative trouble and achieved pulpal anaesthesia in each case without second injection except in two mandibular blocks. Pulpal anaesthesia lasted at least 40 minutes and may have lasted longer though I could not prove it. These solutions have been employed amongst my patients but sometimes it is impossible to gather all the information one would desire and perhaps I have used greater volumes of solution than was necessary. I found 1 c.c. was adequate for most maxillary teeth by infiltration with a usual spread to the tooth on either side. For the first molar I used 1.5 c.c. In mandibular blocks twice I needed more than 2 c.c. to obtain pulpal anaesthesia. Onset seemed very quick in the maxilla, mandibular blocks requiring five minutes for pulpal anaesthesia.

It is difficult to compare this solution with others on such a small number of cases. I felt, however, that its onset compared favorably with UNACAINE and XYLOCAINE (possibly slower) with a duration between those two. It is undoubtedly a potent local anaesthetic solution. The only side effects observed consisted of occasional pallor of short duration.

The reports from manufacturers (there are no independent published reports to date) concerning onset and duration would appear to be soft tissue effects as opposed to pulpal anaesthesia. This I found was usually present about three minutes after the first signs of soft tissue effects.

The duration of pulpal anaesthesia was once only 30 minutes, but usually over 40 minutes: the final symptoms had frequently disappeared in two hours.

Vaso-constrictors.

Having discussed the recent local anaesthetic drugs I come to the new vaso-constrictors. Here, I think, is a very big advance. Most local anaesthetic solutions except cocaine, in concentrations and volume used in dentistry, are not greatly toxic except when used for patients who have an idiosyncrasy to that drug. The big hurdle to surmount is the patient's own reaction. His restlessness and unease can, with his psychological reactions, bring about anything from nervousness to collapse. Here, with "auto-hyper-adrenalised patients", the dentist's handling plays its part. We now seem to blame the vaso-constrictor for those additional factors of rises in blood pressure, cardiac arrhythmias, rises in pulse and respiratory fullness or rate.

It was recently shown by a series of "blind tests" that procaine or Ringers solution produce no electrocardiogram changes, but adrenaline and adrenaline-containing anaesthetic solutions do depress the T wave of an electrocardiogram. Procaine alone could produce perspiration and some dizziness but procaine and adrenaline also produced tremors and palpitations.

ADRENALINE.

This, as you know, is the most effective in prolonging anaesthesia and in decreasing volumes required for injection. The only serious competitors to date have been its isomer COBEFRIN and NEOSYNEPHRINE. Tainter and Throndson in a series of blind tests found no advantage in 1-10,000 COBEFRIN or 1-2500 NEOSYNEPHRINE compared with 1-50,000 adrenaline. In fact the adrenaline containing solutions required less volume of anaesthetic and produced a higher pulse rate and a lower incidence of nervousness and tremors. However, concentrations of adrenaline stronger than 1-50,000 were usually unnecessary and produced toxic side effects.

Unless distinct ischaemic fields are needed adrenaline is not required in concentrations greater than 1-50,000. Adrenaline can be used as a cardiac stimulant by injection of .25 and .5 c.c. of 1-1000 solution. Thus an injection of a solution containing 1-30,000 adrenaline fast approaches the cardiac stimulant dose if up to 7 c.c. are used. This is not an uncommonly large volume of a procaine solution to inject in one appointment.

One firm in Australia insists, despite advice, on publicising a local anaesthetic solution with an adrenaline concentration of 1-1600. This, of course, is not so, as they have mixed their Imperial and metric systems together in their claim. It can readily be seen that injection of such a solution would be a powerful cardiac stimulant.

The newer vaso-constrictors for use in dentistry that seem worthy of note are NORADRENALINE, OENETHYL and VASOPRESSIN. One author states that 200 vasopressors at least are known. Few have any application to our work.

NORADRENALINE.

LEVOPHED 1. ARTERONOL or NOREPINEPHRINE is a naturally occurring drug found in the adrenal medulla and sympathetic nervous tissue. It was isolated in its laevorotatory, optically active and useful form in 1948. It is allied to adrenaline but lacks a methyl group. Naturally occurring adrenaline contains about 18 per cent. NORADRENALINE. The latter is thought to be the active agent involved in a sympathetic nerve impulse to arterioles. Best and Taylor state that it is only a vaso-constrictor and has little effect in all other adrenaline reactions such as increasing the blood sugar, general metabolic rate, blood pressure, respiration, etc. It is thought to be sympathin E — it does not produce cardiac fibrillations and has no secondary vaso-dilatation like adrenaline; naturally ocurring, it maintains the tonus of blood vessels whereas adrenaline, the "fight or flight" drug is needed more for emergencies.

NORADRENALINE causes a rise in blood pressure, dilates the coronary vessels but produces few subjective feelings and is less excitatory. As a vaso-constrictor it is claimed to be four times safer than adrenaline for the same pressor effect; approximately 1-40,000 was thought equal to 1-50,000 adrenaline. From this it would appear to be preferable to adrenaline for patients suffering from a hyper-active thyroid because of its less effect on the metabolic rate; in diabetics for its lesser effect on blood sugar; for patients with cardiovascular lesions because of the lack of production of cardiac arrhythmias, and in fact all patients for the lesser subjective symptoms it produces and the higher safety factor it possesses.

The solution I have used containing NORADRENALINE is of Australian manufacture and is procaine 2 per cent., AMETHOCAINE 0.15 per cent.; and NORADRENALINE 1-50,000. RAVOCAINE, possibly America's newest local anaesthetic solution contains it and so do XYLOCAINE solutions. If its combination with other procaine solutions proves its original promise we can look forward to bright prospects.

OENETHYL.

2 methyl-amino-heptane is a mild non-toxic vaso-constrictor. It has been used to raise a falling blood pressure during spinal anaesthesia and has recently been advised for and used in dental local anaesthetic solutions for patients with a cardiac risk or adrenaline susceptibility. It does not cause cardiac arrhythmias and has no adverse side effects. It raises the blood pressure, constricts blood vessels, and stimulates respiration. It does not cause a subsequent fall in blood pressure after its pressor effect has ceased.

Nevin has advised its use in anaesthetics for hyperthyroids, cardiac risk patients and arteriosclerotics for tasks of short duration of 20-25 minutes.

There is a standard dental local anaesthetic solution containing this drug in America—1½ per cent. MONOCAINE with 1-500 NEOSUPRANOL (oenethyl).

Harang stated

The availability of OENETHYL as a new vasopressor drug used with NOVOCAINE and FONTOCAINE allows prolonged and profound nerve block anaesthesia without the undesired side effects. Therefore, it is the answer for a local anaesthetic for dental surgery in patients with cardiac disease.

The makers of the MONOCAINE solution do not claim good pulpal anaesthesia but a surgical anaesthesia with a duration of up to 40 minutes.

Vasopressin.

PITRESSIN is the vaso-pressor principle of pituitrin, the extract of the posterior lobe of the pituitary gland. It has not been synthesised and, though in a fairly pure state, may have some other element of pituitrin present, namely, pitocin. It is a relatively weak vaso-constrictor employed in local anaesthetic solutions producing a safe anaesthesia but of short duration.

Vasopressin constricts all blood vessels including the coronary vessels. It has no secondary vasodilatation. Owing to the possibility of pitocin being present as an impurity it may cause uterine contractions in final stage pregnancies and so is contra-indicated for such cases. Because of constriction of coronary vessels it may produce a cardiac anoxia but in the doses used in dentistry this is unlikely (0.5 international unit per c.c.). Vasopressin is more stable than adrenaline and can be stored in solutions of a higher pH.

It is marked in 2 per cent.—4 per cent. solutions of procaine in Ringers solutions, known as PHARMATONIN. The 2 per cent. solution is not a profound anaesthetic but is adequate for surgical work of short duration say half an hour. The 4 per cent. solution produces a more potent anaesthesia relatively slow in onset and short in duration. With the 4 per cent. solution I have noticed a few very slight side effects, pallor, dizziness and some uneasiness. The latter two symptoms may be caused by the procaine but they occur infre-

quently. The 2 per cent. solution was claimed as the least toxic anaesthetic solution on the market. This solution would seem to be indicated for surgery of short duration only and for patients for whom adrenaline presents a hazard.

The 4 per cent. solution can produce a pulpal anaesthesia of short duration, thought longer than that produced by UNACAINE.

The Vehicle of Solutions.

There is now a general tendency to simplify the vehicle. Fresh solutions in normal saline or Ringers solution and stock solutions in saline, plus some preservatives or fungicide such as sodium pyrosulphite or methyl parabenzoate. It has been shown that the pH should not fall below 3.3 but that few procaine solutions are stable above pH of 5.4. The alkaline buffering effect of the tissues is so great that a pH within 3.3 to 5.5 has little effect on the efficiency of solutions. It does, of course, need an alkaline pH to reduce the local anaesthetic salt to its active base. If the difficulty of production and stability of stock solutions were not factors then an isotonic solution with a pH of 7 would appear logical.

Topical Anaesthetics.

Perhaps surface anaesthesia does not appeal to many, but I feel that a very real place exists for it when it is patiently and properly applied. Argument has been put forward that the waiting period is an anxious one, to which I reply that it is only anxious once and at subsequent visits its use will be requested.

It is not time-consuming, as its application can be carried out whilst syringes are being prepared.

BUTYN, NUPERCAINE, AMYLSINE, BENZOCAINE, cocaine, XYLOCAINE and PONTOCAINE seem to have found most favour. Tissues must be dried and at least 2 minutes elapse during which the paste, preferable to liquid must remain against the tissues. I find the liquid is either too wasteful or expensive, or too laborious of application. A cotton roll will hold the paste in place without completely absorbing it.

BUTYN and AMYLSINE BENZOCAINE are available as liquids, NUPERCAINE (Coba), PONTOCAINE (Pharmaton), AMYLSINE, BENZOCAINE (Novocol) and XYLOCAINE (Astra) as pastes. One writer claims good effects from 4 per cent. solution of pyribenzamine hydrochloride, an anti-histamine drug, but I have not found the same success.

I have tried most of the topical anaesthetics on the market and have made up several myself in pastes with barrier cream. Recently my partner and I carried out some blind tests upon one another using cocaine 3 per cent., PONTOCAINE 3 per cent., XYLOCAINE 5 per cent. and AMYLSINE BENZOCAINE, all as pastes. Preference was mutually felt for the XYLOCAINE, then cocaine, AMYLSINE BENZOCAINE and PONTOCAINE. Mention should be made of its more successful application to the less cornified portions of the oral mucosa, the buccal fold being most affected and the palate least.

Other recent advances in addition to local anaesthetic solutions for specific purposes are pethidine, hyaluronidase, penicillin, mephenesin, and the prolonged acting anaesthetics such as NOVESTOIL, EFOCAINE and ANDOLOR.

Additions to Local Anaesthetic Solutions for Specific Purposes.

PETHIDINE.

Also known as DEMEROL, ISONIPECAINE, MEPERIDINE, and DOLANTIN, it is an analgesic between codeine and morphine in potency.

It has been added to local anaesthetics in cartridges or can be aspirated into aspirating cartridges or Luer-Lok glass barrel syringes. Doses vary from 12.5 to 50 mg. Considerable sedation is obtained in addition to a distinct anti-sialogue effect (or depression of the salivary flow). The drug can also be given orally in 25-100 mg. doses.

There is approximately a 10 per cent. occurrence of side effects such as dizziness and nausea with the larger doses.

Pethidine has the advantages of drying the mouth, being an analgesic, raising the pain threshold, as well as its sedation.

Normally I still prefer the barbiturates in the absence of pain since they are powerful sedatives, whereas pethidine is an analgesic.

The antisialogue effect is worthy of remembrance.

Hyaluronidase.

This is a mucolytic enzyme present in certain body tissues as a disseminator. It acts upon the hyaluronic acid present in all tissues (especially connective) as a cementing medium. Hyaluronidase produces temporary removal of the "gel" of tissues and thus facilitates permeability.

Its addition to a local anaesthetic solution brought about (according to one report) a 14 per cent. quicker onset in mandibular blocks and a 10 per cent. higher incidence of profound anaesthesia. Ballooning of tissues disappears more readily and though more effective in blocks it creates a shorter duration.

It is compatible with penicillin, and the usual vaso-constrictors.

Hyaluronidase is frequently used for the reduction of non infective traumatic swellings such as haematomata and post operative swellings. It is available commercially and is an animal testicular tissue extract.

Penicillin.

Penicillin has been suggested for addition to local anaesthetic solution used to achieve anaesthesia in acutely infected areas. This would seem most unwise. The organism concerned may be penicillin resistant, as are many gram negative organisms, and the injection would only spread the infection.

However, penicillin may be incorporated into anaesthetic solutions creating a prophylactic penicillin screen to oppose a later bacteriaemia. Such would be the case before extractions for patients with suspected heart lesions in order to avoid subacute bacterial endocarditis.

Penicillin is miscible with MONOCAINE, UNACAINE, and XYLOCAINE but not particularly with procaine. It is a simple matter to administer 400,000 units of penicillin dissolved in 2 c.c. of XYLOCAINE which could replace the distilled water.

Indiscriminate use is ill-advised, but for a patient with a history of acute rheumatic fever requiring extractions its use is warranted.

Mephenesin.

Known also as TOLSEROL or MYANESIN, it has not been added to local anaesthetic solutions but is mentioned here for its effect in relieving the abnormal, involuntary skeletal muscle contractions of spastic patients. Several articles on its use have appeared. It is available in tablets, capsules or elixirs. The dose is 0.5 gm. per 50 lb. body weight, given a quarter to a half hour beforehand.

It relaxes skeletal muscle, facilitates removal of abnormal reflexes and has no toxic side effects except occasional nausea or blurred vision. It is also a sedative having a "tranquillising effect" but should not be combined with barbiturates.

Reports I have of its use are that it is useful in the less severely affected spastic patients with local anaesthesia and its antisialogue effect is helpful, though general anaesthesia is indicated for the more severely affected spastics.

PROLONGED ACTION ANAESTHETIC SOLUTIONS.

Several aqueous and oily solutions have been produced for injection to achieve a local anaesthetic effect lasting several days. Examples are NOVESTOIL, EFOCAINE or ANDOLOR.

NOVESTOIL has been used dentally to produce an effect lasting at least 3 and not more than 10 days.

The following is a report of its use:

100 surgical cases were treated post operatively by injection of .5 to 3 c.c. depending on the site. 96 had an analgesic effect for at least three days. There were no cases of sloughing or tissue irritation, four were failures.

Strict asepsis, with advice to patients and their co-operation, are essential.

NOVESTOIL has monocaine, benzyl alcohol and benzocaine as the active ingredients.

EFOCAINE is an aqueous solution which is said to form a slowly absorbed crystalline depot in the tissues. ANDOLOR is a non oily solution of procaine and butyl amino BENZOATE.

Its effective duration is six to 12 days and it will flow through fine hypodermic needles whereas NOVESTOIL requires a heavy gauge needle.

Generally the long lasting solutions would be contra-indicated. I have used NOVESTOIL as a block in a fractured mandible but in other than non-infective traumatic cases it would obscure the issue.

SUMMARY.

I see little reason nowadays for regarding some cases as being more difficult to anaesthetise and therefore being used as an excuse for the use of more toxic solutions. Admittedly some are more difficult to anaesthetise; but it is also hard at times to differentiate, so that a temptation exists to routinely use the more toxic solutions. There are sufficient potent and relatively non-toxic solutions available to avoid this.

Again let me stress the importance of assessing the task and the patient before choosing the anaesthetic solution. I would suggest that a general practitioner in dentistry should have at least three solutions on hand.

1. A solution that will have a short duration and quick onset such as XYLOCAINE with adrenaline 1-80,000 or 1-100,000—UNACAINE or possibly RAVOCAINE.
2. A long duration solution such as procaine, PONTOCAINE and NORADRENALINE or XYLOCAINE with 1-50,000 adrenaline.
3. A non-toxic solution for the "risk" patients, e.g., cardiacs, thyrotoxics, or diabetics. This solution should be an adrenaline free solution of XYLOCAINE or one containing OENETHYL or vasopressin.

Local anaesthesia is advancing rapidly. We must discard our cocaine and high adrenaline content solutions and accept the newer substances available today with a promise of still better prospects for the future.

Periodontitis*

Basil G. Bibby, Ph.D., D.M.D.†

As the methods for preventing dental decay are improved (and I am satisfied that rather dramatic progress will be made in the next 15 or 20 years) the mouths in people of middle life will contain more teeth and I anticipate that, as a result, there will be more periodontal disease. That means that now is the time to start working out methods for preventing periodontal disease. When we look at the field we are a little discouraged because at first glance it is quite chaotic. Progress in research in any field consists of building little by little, collecting information at one point or another point, very frequently apparently unrelated, until perhaps this diverse information crystallises out into a reasonable pattern and suggests a practical application. Laboratory tests can only be planned intelligently when a problem has been accurately described by the clinical tests. I am quite convinced that the principal obstacle in the way of solving our dental problems is the absence of good, critical, clinical research. I do not wish to imply that I do not believe we need all the laboratory research possible but I would encourage any one to keep making clinical observations. There is an unfortunate tendency for clinical workers to feel, when they hear of electron microscopes, X-ray diffraction apparatus and so forth, which every self-respecting laboratory has to have nowadays, that the mirror and the probe are useless in investigation — but I still consider them most effective and necessary tools.

Bacteria in Periodontal Disease.

My association with periodontal disease has been principally in the field of bacteriology and so I propose to discuss some of the investigations concerning bacteria in periodontal disease. For convenience, I have divided our study into four parts, under these headings: calculus, acute gingivitis (or Vincent's infection), chronic or marginal gingivitis and, lastly, periodontitis, which term I am using to embrace all the inflammatory conditions of the periodontium. Before we start to examine the bacteriological aspects we must ask ourselves how we can establish a causal connection between any bacteria and these conditions. It quickly becomes obvious that we cannot fulfil Koch's postulates and so I have set up other criteria to see whether we can evaluate the significance of bacteria in these diseases. Three criteria which can be used are (i) an association of specific types of organisms with the observed conditions, (ii) the relationship of the bacteria with the tissues, (iii) the existence of a mechanism which could explain the clinical observations. Let us see to what extent these criteria are fulfilled in different periodontal conditions.

Calculus.

(i) *Association of Specific Bacteria* and (ii) *Relationship with Tissues*: there is an association of specific bacterial types with the formation of calculus. These are certain types of filamentous organisms, the so-called Leptotrichia and the branching organisms, the Actinomyces. A section through a piece of calculus usually shows masses of filamentous organisms on the surface whilst the bulk of the calculus, if decalcified, shows a predominance of filamentous organisms and vibrios. The association is not, however, an absolute one. Throughout the mass there are coccal and other types of organisms but the association has been sufficiently striking for a number of authors to conclude that it is specific. I have seen sections of calculus in which I could satisfactorily demonstrate filamentous organisms but I do not feel there is sufficient evidence to justify saying that filamentous organisms *per se* cause calculus. However there is some evidence to suggest that they may be associated with its formation. They have been shown to have the ability to precipitate calcium salts when grown in a medium in which there are calcium salts in solution. Zander claims that adherent calculus is formed by an ingrowth of Actinomyces into the cementum itself and the calculus cannot be removed properly without thorough scaling and curettage.

(iii) *Causal Mechanism*: it is generally agreed that the calcium salts in calculus are precipitated from the saliva. This precipitation would appear to be related to variation in carbon dioxide tension and it can be postulated that the loss of carbon dioxide results in the release from solution of calcium salts. However unless there is an attaching mechanism of some sort, such as that supplied by bacterial growth on the surface of the tooth, the precipitated calcium salts are not attached to the tooth surface.

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Vincent's Infection.

(i) *Association of Specific Bacteria*: firstly, it is generally conceded that we have an association of certain bacterial flora, namely fusiforms and spirochaetal organisms, with this condition. I think we should also include anaerobic cocci and vibrios. However it is not certain that these organisms are a specific cause. These organisms appear wherever there is an acute inflammation of the gingivae, irrespective of the underlying or remote cause. Therefore it is difficult to say whether the fuso-spirochaetal symbiosis is the result of acute gingivitis or the immediate cause of it. There is some evidence, obtained during the First World War, that acute Vincent's infection can spread epidemically. In the last World War there were no outbreaks of fuso-spirochaetal gingivitis in the American Army, where they went to great pains to maintain the nutritional state of the troops, but I understand outbreaks did occur in the German Army and also in certain concentration camps. In the latter, there appeared to be an association between its occurrence and deprivation of part of the diet as punishment, which could indicate that an increase in the numbers of these organisms followed a deterioration of the patient's systemic condition. There are reports of apparent epidemics of acute gingivitis in some Air Force camps, in which organisms of the diplococcal type rather than the fuso-spirochaetal type were recovered. Having regard for all these reports it would appear unwise to say that a causal relationship had been established between fuso-spirochaetal organisms and acute ulcerative gingivitis.

(ii) *Relationship of Bacteria with the Tissues*: if it could be demonstrated that the fuso-spirochaetal organisms invaded the tissues, there would be reason for believing they play a causal role. Whilst there are drawings of material taken from autopsies in which fusiforms and spirochaetal organisms are entering the tissues, it would be unwise to accept this evidence because it could well be a post mortem invasion.

(iii) *Causal Mechanism*: in the absence of tissue invasion it's hard to explain why inflammation occurs. It is possible that the organisms had proliferated because of the existing inflammation. The other possibility is that products of the bacteria enter the tissues and bring about an irritation without entry of the organisms.

Chronic Marginal Gingivitis.

(i) *Association of Specific Bacteria*: here we are referring particularly to that type of gingivitis associated with accumulation of debris at the gingival margin. It is possible that this type is caused by bacteria because their removal by clinical procedures of cleaning and scaling or by the use of an antibiotic usually leads to a recession of the inflammation. However there does not appear to be a specific infecting organism.

(ii) *Relationship of Bacteria with the Tissues*: a series of studies was carried out by Dr. M. Dewar and Dr. Schultz-Haudt at Rochester in which smears were taken from different areas of the gingivae, namely, the buccal surface of the margin, the crest and pocket; there was evidence of an increase in the fusiform and spirochaetal organisms and other types in the deeper recesses, etc. (e.g. deep in the crevice) in chronic marginal gingivitis. It was not a dramatic change and the only conclusion was that a specific association was possible. There is no indication of invasion of the tissues by any particular type of organism. In a series of some twenty-five biopsies studied at Rochester by Dr. Schultz-Haudt and Dr. Dewar, organisms could be demonstrated on the external surface but penetration of the epithelial or any other tissues by the organisms could by no means be established.

(iii) *Causal Mechanism*: it is suggested that the inflammation is a result of invasion of the tissues themselves, *not* by organisms but by their products which are formed on the surface of the tissue and diffuse into the tissue. That possibility is rather an intriguing one which has not been very fully considered in respect to other parts of the body, e.g. the tonsil and the intestinal tract, where there are great masses of organisms which apparently do not invade the tissues but whose products might cause inflammation and tissue change without entering the tissue.

Periodontitis.

(i) *Association of Specific Bacteria*: here it is not possible to establish an association with any specific bacterial group. Early studies by Goadby in 1910 suggested that there was an increase in certain types of aerobic coccal organisms. Three studies have been carried out in the last five years in an attempt to determine whether some specific types of anaerobic organisms were associated with periodontitis. The conclusion was reached that a bacterial agent was probably involved and Rosebury thought the association constant enough to justify regarding periodontitis as a specific infection. His evidence was that on taking scrapings from these pockets and injecting them into guinea pigs an abcess

formed in which the fuso-spirochaetal organisms predominated. The transference of pus from that abcess to another animal again caused an abcess and this procedure could be repeated through as many as 20 animals. However an attempt to produce such an abcess with pure cultures of the organisms was not successful. Combinations of up to forty different strains injected into animals failed to produce abcess formation unless the products of tissue breakdown were added. This may have some bearing on the nature of the products causing periodontal destruction. Other investigators, using a similar technique, reported that abcesses could be formed by injecting scrapings from any mouth into animals, thus suggesting that no specific bacterial cause can be detected by this method.

(ii) *Relationship of Bacteria with the Tissues*: if it could be shown that bacteria always invaded the tissues in periodontal disease there would be some reason to assume that bacteria were the cause of the disease. However this is not so. Fish carried out investigations in which he implanted organisms in bone and compared the reaction with that seen in periodontal tissues. In bone there was an acute, polymorphonuclear type of reaction and in the tissues there was a more chronic type of reaction. Sections through the periodontal pocket showed that the organisms were externally placed. Therefore we can only explain the reaction as before; that is, that products of externally placed bacteria cause the underlying reaction. This idea is not really new. Fish suggested that "histamine-like" products were elaborated which entered the tissues, and Beckwith has produced tissue reactions with sterilized preparations of gingival debris. Since no attempt seems to have been made to determine the nature of such tissue-destructive bacterial products, we carried out an investigation on that subject.

Investigation on Nature of Bacterial Products Causing Tissue Destruction.

In order to establish whether gingival bacteria produced tissue-destructive products and to find out something more than is known about the nature of such products, we prepared cell-free extracts of bacterial debris collected from the gingival margins and injected them into the skin of animals and humans. In one human subject a violent reaction developed in four or five hours; at forty-eight hours a slough had formed in the centre and three weeks later only a scab remained, but in others there were only mild or negative responses. In animals we saw variable reactions: sometimes there was a transient flush (which one would expect from the injection of histamine-like products) but when the animals had been previously sensitized there was evidence of a greater inflammatory response of the allergic type. However, it was found subsequently that if carbon particles were injected into rabbit skin prior to an injection of this bacterial extract, there was a spreading of these carbon particles over a wide area. This indicated that there was an agent in this bacterial tissue extract capable of causing spreading of carbon particles. Hyaluronidase, the enzyme which breaks up hyaluronic acid in ground substance and in the cement material of cells, causes such a reaction. Tests also indicated the presence of a collagenase and sulphatase capable of attacking chondroitin sulphate. Thus there was evidence of the presence in these bacterial extracts of three agents capable of breaking down the supporting structural background of the gingival epithelium.

A rather heroic series of biopsy specimens was obtained from human subjects to whose gingivae hyaluronidase had been applied for various periods of time. It was shown that applications of hyaluronidase to the gingival epithelium produced changes which resembled those seen in gingivitis. One of the effects of a short application of hyaluronidase was the appearance of glycogen granules in the epithelial cells and an increased permeability of the epithelium. The hyaluronidase apparently had the ability to dissolve out the cementing substance and thereby open up the tissue, thus (theoretically at least) making it more susceptible to the penetration of any tissue-irritating substance that might be on the outside and we can perhaps regard the degradation production of broken down tissues as being potentially irritating substances which could cause inflammation. Where prolonged applications of hyaluronidase had been made, it was possible to show the actual penetration of bacteria into certain areas through the sites of increased permeability which had developed in the epithelial tissue. If we assume, then, that bacterial by-products can produce tissue-destructive agents, which could open up the tissues to invasion, we can see how bacteria can be important in periodontal disease.

This hypothesis is of importance not only in periodontal studies but in the whole problem of the tissue invasion by bacteria. The effect of hyaluronidase on epithelium has not been previously described but it could well be that hyaluronidase-producing organisms in the normal flora make a mucous membrane more easily penetrable by viruses or other pathogenic organisms. Thus, as a precursor to infection, there may be a change in the nature of the basic bacterial flora which so alters the

defensive mechanisms of the mucous surfaces that they become more susceptible to invasion. It is my conviction that, as dentistry by studying such basic problems is able to make contributions to medical and general science, such studies more than any other kind, will be the means by which the professional status of dentistry will be raised and by which we shall win the respect of scientists in general.

Dr. Dewar:

You mentioned that Dr. Schultz-Haudt has found collagenase and chondroitin sulphatase in the exudate of periodontal pockets. Were the organisms which produced these enzymes identified?

Professor Bibby:

No, not yet.

Mr. Levine:

What part do you think the keratinised epithelial layer plays in chronic marginal gingivitis? In a pregnancy gingivitis there is a loss of the keratinous layer and regular massage is prescribed in order to increase or maintain keratin formation. If this is not done the chronic marginal gingivitis remains. Is it possible that by massage we are merely getting rid of bacteria and their end-products? Lastly, could it be that invasion of the tissue occurs only where there is no keratinisation?

Professor Bibby:

I think the important point is the one you have made yourself. If treatment is given which is aimed at increasing the gingival keratin, there is a decrease in the depth of the pocket and consequently a reduction in the numbers of bacteria. Thus a cure is effected even though it is by means of a different mechanism from the one anticipated.

In answer to your second question, the hyaluronidase does enter the gingiva through the pocket, the epithelium of which is generally considered to be non-keratinised. Hyaluronidase was not tested against the keratinised marginal epithelium.

Dr. Kirkpatrick:

From time to time substances have been added to dentifrices in order to prevent the formation of calculus. Mucinase is such a substance. In the absence of any evidence to the contrary, I think that simple toothbrush massage is just as effective.

Professor Bibby:

I don't think there is any evidence for thinking that the addition of mucinase would be any more effective than using a toothbrush only in removing material from the gingivae at an early stage of inflammation. I think the brush is probably the best way with or without a dentifrice. Of course there have been quite a variety of chemicals used at one time or another. Some have been quite effective in taking off the cementum too!

Dr. Sullivan:

There have been numerous reports in the literature of oral inflammatory conditions developing subsequent to the use of different antibiotics. Has any study been made of the flora remaining in the mouths under such conditions, particularly with reference to their ability to produce hyaluronidase?

Professor Bibby:

I don't know of any study which has made a serious attempt to analyse such a change in bacterial flora. However a rather interesting and related observation on the use of penicillin has been made in Rochester. About five years ago only 15 per cent. of the patients in the Strong Memorial Hospital and the Eastman Dental Dispensary had penicillin-resistant staphylococci in the mouth: a year later there were 40 per cent., and in the last survey over 70 per cent. There is thus a wider distribution of the penicillin-resistant strains. This may be what is happening in some of these patients—there may be some penicillin-resistant organisms which have developed and are now causing a condition which previously did not occur.

Dr. Rowell:

There seem to be periods during life when one is susceptible to dental caries but not to periodontal troubles and vice versa. Can this be explained by any known antagonism? Does the pH of the saliva play any part?

Professor Bibby:

I know of observations made on the pH of saliva of patients of all ages from early childhood to old age, and it was possible to demonstrate a variation in the acidity of the saliva. There is some suggestion but as yet no proof that the salivas of the older patients may be a little more on the alkaline side. In respect to antagonism between dental caries and periodontal disease, there are some interesting points. The teeth which are most susceptible to periodontal disease are those which are least susceptible to caries. If you graph age against susceptibility, the percentage of new cavities goes up rapidly to up to twenty a year or so and then comes down; the curve of the appearance of periodontitis

comes up where the other one comes down. There are quite a lot of conflicts about this subject but there is nothing very concrete.

Mr. Martin:

Could you explain what part you think oxalates of the diet play in calculus formation?

Professor Bibby:

In regard to oxalates I think you have a different condition there because all the analyses that have been made of salivary calculus, including those made from X-ray diffraction pictures, seem to indicate that it is essentially a calcium phosphate of the apatite type. So I think the oxalate problem is an artificial one: I think perhaps it might be important in getting residual deposits at the point of irritation or something of that sort perhaps following the use of oxalate-rich foods.

Mr. Martin:

Do you feel that Spies and Mann's ideas on end-products of protein degradation being antagonistic to acid-production explain the periodontitis-caries antagonism?

Professor Bibby:

The work of Spies and others really repeats what is in effect a fairly well known phenomenon. Where you have proteolysis occurring, you don't have acid-formation. While I agree entirely with the theory, I don't think it has established any new principle. On the whole the pockets are more acid than I expected them to be—I thought they would be more on the alkaline side. Zones of inflammation and tissue breakdown tend to be acid.

Dr. Lilienthal:

The pH at which bacteria break down substrates is of interest. Decarboxylation takes place at pH 5.0 but at pH 7.0 deaminases are active; these leave organic acids as end-products.

Mr. Levine:

Vincent's infection is frequently considered infectious. Would you agree with this?

Professor Bibby:

I would modify that view just slightly. We have to consider the possibility that we may have a susceptible population. Then, as we know does happen in bacterial infections, a more virulent strain can develop, so that where you had a susceptible population you might get an epidemic. Such apparent epidemics of Vincent's and laryngitis can be viewed in this light. So while we didn't see them in well nourished troops in the recent war, in the First World War it was so prevalent among malnourished troops that it was considered infectious.

Dr. Goldsworthy:

Do you think that hypersensitivity or so-called allergy may play a greater part in gingival diseases than we have in the past considered likely?

Professor Bibby:

I think this might well be so.

Dr. Goldsworthy:

Professor Bibby's address on a most contentious group of diseases is surely more encouraging than he led us to believe. Thus the demonstration that bacteria in pockets can and do secrete enzymes like hyaluronidase and sulphatase is, I do think, progress in the right direction. Much of his address has been to me at least, a vindication of the essential unity of the two great professions of Medicine and Dentistry and of the fundamental unity of Science—but it would be merely tedious to analyse the address from this angle.

Finally, may I be permitted to draw attention to our speaker's restraint in the use of that overworked word "toxin." In our present state of ignorance, Professor Bibby's phrase "bacterial product" is infinitely to be preferred.

Dental Teaching And Trends In Operative Dentistry In The United States Of America*

A. W. Bull, B.D.S. (Syd.), D.D.S. (N.U.)

The Dental Schools.

Curricula.

In the United States of America it is necessary for students to attend a four-year University course in order to graduate in Dentistry. Prior to that, they have attended high school and college for 14 years which means that they will graduate at the age of 23 or 24 years.

*A lecture delivered to the Australian Dental Association (New South Wales branch) on March 23, 1954.

In the colleges there is a basic two-year pre-dental course which is a required minimum before the student enters a dental school. If the student wishes, he can remain for three years and complete a Baccalaureate degree and some 25 to 30 per cent. obtain a bachelor's degree before beginning their dental course. The pre-dental courses include the compulsory subjects of chemistry, organic chemistry, physics, biology and English. Along with these are elective subjects of a liberal or cultural nature.[1] Thus, when a freshman arrives at the dental school he has finished some of the first-year subjects which are included in the curriculum at our own University.

Table 1 shows an outline of the course at one of the dental schools. It shows both course content and sequence and can be used as a means of comparison. It will be seen that anatomy is completed in the first two terms of the first year. There is no chemistry or physics. In the second year physiology is also completed in two terms, and bacteriology in one term. There is much concentration of courses, sometimes as many as two lectures and two laboratory periods being held per week.

Oral anatomy is a first-year course which is very thoroughly covered. In it there is early emphasis on perfection in tooth carving. A high standard is required in this first introduction to manual exercises and it paves the way for similar emphasis in all practical work which follows.

Technical operative dentistry is completed by the end of the second year and the student enters the clinic late in the second year, or early in the third year.

One of the interesting features of the fourth or senior year is the holding of seminars. A student is assigned a topic on which he prepares a paper and presents it to a group at a meeting conducted like any dental society meeting. In the second year, a course known as technical compostion has been given on how to prepare a scientific paper and, as a result, these papers are well prepared and usually well presented.

TABLE I

OUTLINE OF COURSES AND COURSE SEQUENCE AT AN AMERICAN DENTAL SCHOOL.*

		1st Year			
Hist.	Anat.	Oral Anat.	Dental Materials.	Orientation.	1st Q.
Bio-Chem.	Anat.	Oral Anat.		Pros.	2nd Q.
Chem.		Oral Anat.	Dental Materials.	Pros.	3rd Q.
		2nd Year			
Physiol.	Bact.	Tech. Comp.	Oper.	Pros.	1st Q.
Physiol.	Path Oral Hist.		Oper.	Pros.	2nd Q.
Pharm.	Path.	Radiol.	Oper.	Pros.	3rd Q.
		3rd Year			
Med.	Anes.	O. Path.	Ortho.	Ped.	Comp. Dent.	Clinic
Med.	Oral Surg.	O. Path.	Ortho.	Oper.	Prtl. Dent.	Clinic
Med.	Mat. Med.	O. Path.	Ortho.	Oper.		Clinic
		4th Year			
O. Surg.		Prac. Man. Prtl. Dent.		Seminars	Clinic
O. Surg.		Juris.		Round Tables	Clinic
O. Surg.		Ortho.		Surg. Clinics	Chem. of Caries. Photog.

* The exact quarter in which a course is given in the senior year is variable—since sections are rotated.

Usually, the dental school conducts all its own classes separately from the medical classes, even though the medical and dental schools may be housed under the same roof. This autonomy is a characteristic feature of all schools.

To review the course briefly, I would say that more time is spent in the clinics by the American students although a lesser amount of work is done. The basic sciences are not so thoroughly covered nor is their scope as broad. However, this emphasis on clinical training is not a new feature for, as far back as 1838 Horace Wells pointed out such differences when comparing European and American schools.

Staff.

The majority of teachers in the clinical subjects both at the clinical and pre-clinical level hold part-time appointments. Usually they are successful practitioners and an association with a dental school is sought after and considered highly both by the profession and the patient. At the present time I would say that schools are having more difficulty than usual in keeping together a good teaching faculty. This does not apply so much in basic sciences or to the older members of the faculty as in clinical subjects and to younger men. There are probably two main reasons for this: one is the draft situation, which keeps 7000 dentists in military service permanently. The other reason is such good times are prevailing in general practice, that it is more attractive financially.

Aptitude Tests.

An aspect which is of interest, and of recent development, is the growth of the aptitude testing programme. This situation has arisen from the fact that there are about four times as many applicants for places in the dental schools as there are vacancies. In 1946 the Council of Dental Education of the American Dental Association and the American Association of Dental Schools decided to carry out an experimental programme of aptitude testing. All the accredited dental schools volunteered to co-operate for a five-year period. The test data collected during these five years was considered sufficiently useful for the schools to request that the testing programme be used on a nation-wide basis and that all students under consideration be given aptitude tests. So now, from approximately 11,000 applicants each year, 7000 are given tests to see who will fill the 3300 vacancies. By use of these tests there has been a reduction in the number of failures which might be attributed to poor scholastic ability. It is now expected that from every 3300 entrants, 3000 will graduate — a mortality of only 10 per cent.[2] From this study some interesting facts emerge. It is well known that practitioners of dentistry require a unique combination of academic and technical ability. The findings of these tests indicate that high general scholastic aptitude, comprehension of scientific activities and at least above average mechanical dexterity are associated with success in the dental school. The tests are many sided: the practical test usually consists of a chalk carving exercise, and the candidate has to make certain cuts and shapes from it to indicate his dexterity. A question is included to see if he can visualise the reconstruction of two- or three-dimensional patterns. In addition, there are questions which require the candidate to apply principles and solve problems in the field of biology and chemistry. The outstanding fact about the programme is that it is working successfully. There is no doubt that this success in reducing the percentage of failures is a progressive step. It reduces wastage of teaching time, school money, student's time and money, as well as preventing the demoralising blow of failure with its bad effects on any young man's future. I do not think that claims for its success are extravagant. It is realised that the system is an aid and does not replace the need to use the student's previous academic record, nor a personal interview. It gives no measure of character but, within its limits, has distinct value.

The Dental Hygienist's Course.

These courses are conducted by 29 schools or institutions. It is a two-year course leading to a certificate or diploma in oral hygiene. At the present there are about 5000 girls practising as hygienists and there is a demand for more. They may be employed by dentists, by the Department of Schools or by the Department of Health. Their work may consist of lecturing on diet, nutrition and oral health topics; they can make topical applications of sodium fluoride, carry out an oral prophylaxis and they can take radiographs. The course will have included something of book-keeping for a dental office as well as simple laboratory procedures such as pouring models, investing and making indirect inlays from the impression stage to the finished casting. They are not permitted to be self-employed but must always be employees.

Operative Techniques.

The Self-Curing Resins.

These plastics have caused more enthusiasm and interest than any other substance in

recent years. They have also provided more failures than any other material. Since their inception after the war the early enthusiasm was dealt some severe blows in America, as well as here. Many of the new fillings discoloured and became loose in their cavities. There was a reaction against them and for the first time in two years the sales of silicate cements improved whilst that of the resins fell off. Then came a manipulative improvement in the "Nealon," "brush" or "compensating" technique of filling the cavity. Fewer fillings became loose but the material was still not colour-stable. This was followed by a distinct improvement from the De Trey's Company in the form of SEVRITON. In it, the unstable tertiary amine activator was replaced by sulphinic acid, which was claimed to be colour-stable. This caused a lot of interest and within a couple of months the American manufacturers had similar products on the market. That is the situation at the present time.

Let us look critically at the resins. Are we to stop using silicate cements, or shall we wait and see, and treat resins as being still in the experimental stage? As good a way as any of evaluating a filling material is to examine it in the light of the requirements of primary and secondary importance for a filling material as laid down by G. V. Black.

In the following paragraphs the qualities required by Black are set out, followed in each instance by an assessment of the resins in that regard:

I. Qualities of primary importance.

(a) *Indestructibility in the fluids of the mouth.* Excellent: solubility is less than one-tenth of one per cent.

(b) *Adaptability to the cavity walls.* Moderately good: this is especially so when the resin is in the more fluid state as, for example, in the brush technique, or when a more fluid mixture is used in the pressure technique. However, an excess of monomer is a danger as it may cause too much polymerisation shrinkage.

(c) *Freedom from shrinkage or expansion.*

(i) *Polymerisation shrinkage*: the accepted figure of six per cent. to eight per cent. seems a great fault, but there are factors which seem to lessen it considerably, making it acceptable clinically. They are the adhesive quality of the improved resins, the use of a laminated or stratified technique of filling or the use of the brush or compensating technique (unsuitable for SEVRITON or ORTHOFIL).

(ii) *Thermal expansion or contraction*: dimensional changes caused by the high co-efficient of thermal expansion constitute a serious shortcoming. The material expands and contracts 7.2 times more than tooth structure with temperature fluctuation.[3] If ice or ice-cream is followed in the mouth by hot tea or coffee, there can be a temperature change of forty-three degrees centigrade in the filling material. As the resin expands or contracts seven times more than tooth structure with each variation in temperature, seepage of fluid can and does occur between the surface of the cavity and the resin restoration. This interchange of fluids, known as percolation, can be the cause of marginal staining and, of course, the development of recurrent caries. There is no doubt that caries, once started, progresses rapidly under resin fillings.

(d) *Resistance to attrition and the ability to sustain the forces of mastication.*

The physical strength of the material imposes strict limitations on its area of use and it cannot be expected to resist occlusal wear as it is a soft material. It has a low Knoop Hardness Number[3] but this does not perhaps give a fair idea of its wearing property because it does not indicate resilience or brittleness. For example, a brittle silicate cement restoration with a higher K.H.N. than dentine would fracture when exposed to stress that the elastic dentine could sustain. However, the resins will not stand up to occlusal wear and its use in incisal restorations must be determined conservatively, considering life expectation of such a restoration equivalent only to that of a temporary filling material.

II. Qualities of secondary importance.

(a) *Colour and appearance.* Excellent: the best that we have known, although it is sometimes temporary. It was because of the great public interest in its aesthetic value that the use of the material was given such impetus. This introduces the ever-present conflict between appearance and mechanics between which the dentist is always compromising.

(b) *Non-Conductivity.* Good.

(c) *Convenience of manipulation.* Only moderate: it is not an easy material to handle. It is sometimes difficult to apply to a small cavity if the temperature is high and setting is rapid. Further, it is necessary to hold the matrix still until material is hard and it is often difficult to eliminate moisture.

It might be well to mention, at this point, a few points in technique which are taken mainly from the excellent work of McLean and Kramer.[4]

(1) The cavity should be filled to excess, preferably with a somewhat fluid mix. This helps in adaptation to the cavity walls and in the proper placement of the material before it reaches a leathery unworkable stage. McLean says,

> After inserting 650 in two years we have concluded that it is preferable to err on the fluid side at insertion.

(2) If large contour restorations are attempted the resin should be built up in three or four layers. Preferably the first layer should be inserted and polymerised on to the cavity wall as a seal. The remainder, as a standard mix, should then be applied in a suitable resin corner form. Care should be taken not to let a fluid mix adhere to the adjoining tooth as contraction would tend to be directed towards this free surface.

(3) Care must be taken not to allow an excess to set below the gingival margin for it is such a good colour it is difficult to see and it cannot be chipped or flaked off. It has to be burred away and if left will act as a foreign body; a frequent enough occurrence to originate the description "resin gingivitis."

(4) The improved cavity seal only helps retention and mechanical undercuts are still necessary. We might make the mistake of depending too much on the adhesive quality, particularly when one sees such commercial demonstrations as a lump of resin attached to an extracted tooth which cannot be wrenched off. There is a great difference between the resins adhesive properties in such *in vitro* tests and in the conditions under which it is used in the mouth.

(5) There is no uniformity of opinion as to their effect on pulpal tissues. As the safety of the pulp is at stake, caution is essential. The same attitude that we apply to the silicate restorations should apply to the resin restorations. Medium and large cavities should be lined with bases of fine oxy-phosphate cement.

The conclusions that I would draw from this study are that the indications for the use of self-curing resin restorations are:

(i) Class V or gingival cavities where the aesthetic effect is important. There the mixture should be used in a rather fluid consistency and not necessarily with any pressure from a matrix.

(ii) The need for restorations in mouths (such as those of mouth breathers) where silicate restorations have failed.

(iii) Facings for inlays.

(iv) Class IV incisal angle replacement where the bite is free.

Before using them unreservedly I would like to feel more confidence in their lasting qualities. After all they are new, and even though they show immense promise for the future, we have had such a history of failure with acrylic inlays and the early self-curing resins that a "wait and see" attitude seems a wise one to adopt.

Silicate Cement Restorations.

There are many people who have not discarded the silicate cements and the Bureau of Standards has recently issued a publication which sets out a new mixing technique which should do much to improve the physical properties of the restorations.

Silicate cements are probably the most abused filling materials in use today and because of this misuse the material rarely displays anything like its optimal physical properties. This material is very susceptible to moisture during manipulation and yet often a dry field is not obtained and rubber dam is rarely used. Often the mixing slab is not cooled and frequently the mix is overspatulated. Any one of these errors is sufficient to ruin the mix and a filling is obtained which falls far short of the material's potential.

The technique suggested by the Bureau of Standards[5] was based on the following data:

> Silicate cements being essentially aqueous solutions of phosphoric acid are hygroscopic. Consequently when exposed to air the liquids take on or give off water depending on the amount of moisture in the air. This gain or loss of water which greatly affects the setting time of the cement occurs principally when the cement liquid is exposed to the air during the withdrawal from the bottle, while the liquid rests on the glass slab prior to mixing and also during mixing of the powder and liquid. The cement liquid should not therefore be exposed to air if ideal conditions are to prevail in mixing silicate cements.

Also the temperature of the glass slab on which the cement mix is prepared markedly affects the amount of powder that can be incorporated in a given quantity of liquid to produce a workable plastic mix. If the slab is cold a high powder: liquid ratio can be obtained and the cement will be stronger, less soluble and have less shrinkage than if a warm slab is used. Unfortunately, however, water will condense on the slab when it is chilled much below room temperature during hot and humid weather.

With this in mind the group devised a method which would eliminate exposure of the silicate cement liquid to the air during storage or mixing and which would permit cement to be chilled and kept moisture-free during mixing, independent of air temperature and humidity. Such a mixture results in a restoration with a high compressive strength, low solubility and small setting shrinkage regardless of weather conditions.

Their method of sealing the powder was to place the exact quantity of powder required in a balloon, cut off the end and seal the cut end with rubber cement. A nurse can weigh out and seal up sufficient in an hour to last for weeks. The liquid is kept in a sealed serum or antibiotic bottle, and the exact quantity is withdrawn by aspirating it with a small tuberculin syringe. This is then injected into the balloon and the mix is made by kneading and working it with the fingers in a basin of cold water. With this technique one can incorporate up to twice as much powder with the liquid as is on a slab on a hot day, because the weather factors — temperature and humidity — have been eliminated.

Skinner says that a dentist cannot do a good silicate restoration on a hot humid day and some technique like this could well be the answer, if the manufacturers would sell their powder in pre-weighed and packaged containers.

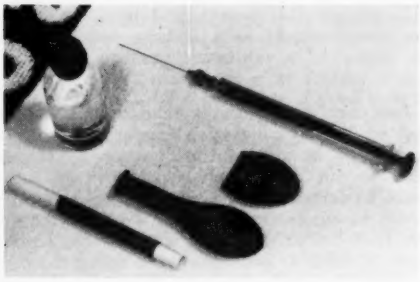

Fig. 1.—The equipment required for the mixing of silicate cements. Illustrated are a tuberculin syringe, sealed rubber balloon containing silicate powder, a measure for silicate powder and a bottle with a rubber seal for silicate liquid.

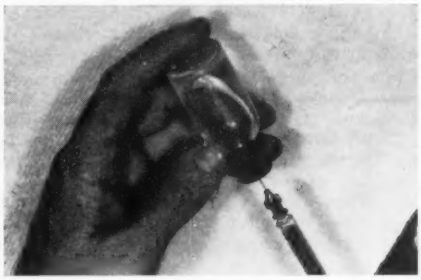

Fig. 2.—The aspiration of liquid by means of a tuberculin syringe.

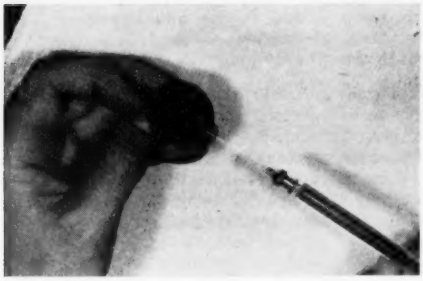

Fig. 3.—The injection of liquid into a sealed rubber balloon containing silicate powder.

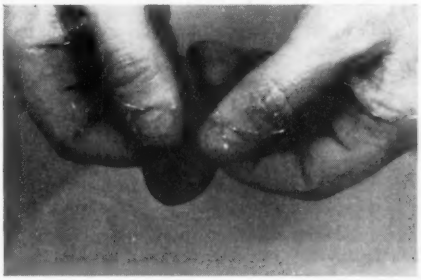

Fig. 4.—The mixing of the silicate powder and liquid under cold water.

Diamond Instruments.

The use of diamond tools is not new, but until Ingrahm and Tanner[6] presented their techniques, methods of cavity preparation

were left to the individual operator. They set out a standardised procedure with a definite cutting sequence. They cut from the external surface inwards and use a very fast engine speed — anything from 12,000 to 20,000 r.p.m. Using diamond tools of their own design they have developed a fast and good cavity method of preparation.

They have five or six contra-angle heads set on the bracket which are already loaded with the diamonds to be used. Direct vision is used wherever possible with the contra-angle handpiece. Some points worthy of note in their techniques are:—

(a) High speeds are required for efficient cutting. (Rate of cutting increases proportionately with increase in r.p.m.)

(b) Diamond instruments are best used with a light pressure and greatest efficiency is obtained with one pound pressure.

(c) The points cut most rapidly when used with spray of water as it stops the diamond from clogging.

(d) They cut harder substance more efficiently than soft. Diamond instruments should be used for cutting enamel, and burs for cutting the less dense dentine, cementum, amalgam or other filling materials.

(e) Diamond instruments should be used in a dragging rather than in a pushing movement in order to obtain better control.

(f) Care must be taken to keep these rapidly cutting instruments out of contact with surfaces outside the field of operation.

The following description of the cutting of a Class II cavity indicates the way in which the diamond points are used:—

The first diamond instrument used is a very thin safe-sided disc, 9mm. in diameter. The safe side is held firmly against the adjacent tooth and the disc positioned as conservatively as possible to avoid over-extension. It is positioned correctly before the motor is started and the disc then penetrates from the marginal ridge area to the gingival on the buccal aspect.

The second cut is made from the lingual aspect and is similar to the first cut, the buccal and lingual cuts meeting or almost meeting, in the median groove. A flat occlusal wheel is used for the third cut. It is run in a mesio-distal direction. It penetrates into the dentine and is rocked buccally and lingually in order to keep within the final occlusal outline. A larger wheel is used for molars or high-cuspid teeth. The touching of shank on the cusp prevents too deep a cut being made into the dentine.

A size three inverted cone carbide bur is used to remove the remaining proximal bulk. This leaves some unsupported enamel at the gingival margin which is fractured away with an enamel hatchet. Thus the outline form is established in some four or five steps.

To review this technique I would say that the establishment of a definite sequence and the using of a minimum number of instruments results in a rapid cavity preparation.

Just how long does it take to cut such a cavity? This is a question Ingrahm would not answer — he evaded the question by saying that he did not intend quoting times as it could deteriorate into a race in which quality would be secondary to speed. However, he did say that his cutting time was reduced to one third of what it had been when using the conventional methods.

One of the disadvantages of any new technique is its abuse by enthusiasts, and in this particular case misuse can have disastrous results. The thin wheels can cut tissue like a razor if they slip. There was a case reported in California where an external carotid artery was severed and I saw and heard of many instances where the cheek and floor of the mouth were badly cut.

Another possible disadvantage is that it is easy to over-extend the outline form. This can happen by misapplication of the first cut. Whilst over-extension is usually good preventive dentistry, it is not aesthetic dentistry, particularly if the cavity is on the mesial surface of bicuspids or first molars.

Aids.

I. *Air Dent Machines.* The Air Dent machine has suffered a temporary eclipse. The early enthusiam has waned, probably for two reasons: firstly, the cost is high (1850 dollars — for which a new Chevrolet can be bought) and secondly, it does not do enough. It does not replace the rotary bur. A bur is still required to do fine cutting and to prepare sharp line angles, flat walls and the more precise cutting.

The inventor — a dentist named Black — is quite sanguine about its future, but he en-

visages it as an auxiliary—much more compact and probably attached to the unit, so that you can reach out for either the rotary handpiece or the air abrasive handpiece. In that form it probably will be useful and successful.

II. *Rotor Seats.* It is interesting to note that some of the dental schools have introduced the use of the rotor seats and operating stools and the students use them efficiently and comfortably. With the cabinet conveniently situated, it and the bracket tray can be reached by stretching out an arm. It is only a matter of habit and whereas a dentist, used to standing at the chair, finds it difficult to change, the student has nothing to unlearn and starts a habit that will give him a lot more comfort while operating over the years than most of us experience.

The rotor seat, of course, has a good range of movement from behind the chair to the front right position. The rheostat is attached to the moving horizontal base and is constantly in the same relation to the feet.

III. *Double-ended hand instruments.* This idea is not new in relation to excavators and explorers. However, at least three manufacturers have placed on the market a series of double-ended chisels, hatchets and marginal trimmers. For anybody who makes use of these tools they are an economy and a convenience. Invariably, if a hatchet is used it is necessary to have both the right and left for opposing walls. The same applies to a gingival marginal trimmer or a bin-angle chisel. With the new instruments the second tool is already in your hand and you do not need to reach for it on the bracket or in the cabinet. The instruments take up less room, are cheaper, and save operating time.

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A Technique for the Construction of Consistently Accurate Bridges*

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This paper sets out a procedure which is regarded as containing the basic principles of good bridgework. Nearly all new ideas and modifications are derived from this procedure.

The standards by which bridgework are judged have changed. Although it is now commonplace to find artistic staining, good colour shading and matching of pontics, the features which we seek most these days are harmony in function and durability. If the occlusal surfaces of a bridge are not in functional harmony with the remainder of the teeth, there is a lack of fulfilment of the requirements of modern bridgework. Therefore, after completing our clinical and radiographic examination of the mouth, our next task is to equilibrate the occlusion. Briefly, this is performed as follows:— the general plane of occlusion is re-established anteroposterially, checking the general curvature of the buccal cusps, and reducing any that are out of line. Then, using thin typewriter carbon paper the patient is asked to close lightly in centric occlusion, at the same time resting a finger on the buccal of each tooth. Any premature contact is corrected by grinding the upper and lower teeth. The patient is then shown how to close in the right lateral position so that the buccal cusps of the upper and lower teeth come into contact. Often only cuspids and lateral incisors are found to contact. This is corrected by grinding the lower lateral incisor and cuspid initially until a posterior tooth touches. The buccal cusps of the upper teeth and the lingual cusps of the lower teeth on that side are then ground. As this continues, contact may be found on the left posterior teeth. These are then reduced by grinding the inclined planes of the upper teeth and

* Read at the 13th Australian Dental Congress, Brisbane, June, 1953.

the buccal cusps of the lower teeth until as many posterior teeth as possible are in contact in this right lateral excursion. From the right lateral position the patient traverses across to centric, any interference in this movement being reduced and harmony established on that side.

The same procedure is carried out for the left lateral excursion and protrusion, followed by placing abrasive paste on the lower teeth and asking the patient to grind his teeth together until all minute imbalances are removed, but not long enough to cause a closure of the vertical dimension. Examination will disclose flat facets on the occlusal surfaces which must be re-shaped to increase the masticatory efficiency and lessen the strain on the teeth. The mesial and distal of these facets are ground with fine stones, keeping the crest of the facet in occlusion and making spillways on either side.

In selecting the abutment to be used, common sense primarily dictates design in relation to the type of tooth or teeth, amount of retention available, the hygiene of the finished bridge, the occluding stresses and aesthetics. The literature on bridgework is loaded with new designs for abutments and various modifications of the classical designs. The use of pins for retention, which finds great favour, nearly always will overcome the problem of displaying gold in obvious sites.*

In addition to enhancing the aesthetic effect, pin retention is desirable in the many cases in which abutments are required on sound teeth, as quite often sufficient retention may be gained by joining several pins together by a fine veneer of hard gold. The preparation of these abutments is most speedily achieved by the use of very high-speed diamond stones and burs.

As an example of our technique we shall describe the replacement of an upper lateral incisor by a stress-broken bridge, having a three-quarter veneer as the principal abutment on the canine, and a stress-breaker in a pinlay on the central incisor. Under local anaesthesia and using large diamond stones revolving at very high speed the lingual of the canine is reduced to accommodate a fine veneer of metal in all jaw excursions. Mesial and distal slices are cut, converging slightly incisally and lingually and carried sufficiently far labially to ensure protection against any future caries. A groove is then prepared in each slice as far labially as possible and parallel to a tangent to the face. The preparation is then finished below the gingiva with or without a shoulder, and with or without a cingulum pin hole or incisal groove, according to the existing conditions. The stress-breaker on the mesial end of the bridge is in essence, a precision attachment through which masticatory forces are directed apically along the root. Thus the preparation of the cavity on the central incisor should include a fairly deep distal box to accommodate the stress-breaker and be retained by a dove-tail or pins.

The next stage in this technique is the taking of hydrocolloid impressions. Two impressions of the arch are taken concurrently. The bridge and inlays may all be constructed simultaneously from these two impressions. This method has numerous advantages over other techniques as the models from hydrocolloid impressions give detailed anatomical reproductions of the prepared cavities, the teeth and the soft tissue, which enable the dentist to design prosthetic restorations more serviceable to the patient.

A most important factor in this technique is the availability of all the margins of the preparation. The reversible hydrocolloids are too soft and too fluid to displace any gingival tissue, so that any margins that approximate, or are below, the gingivae must be exposed by retracting the gingivae by one of the following methods:— application of styptics, chemical cautery, surgery or vaso-constriction. In conjunction with styptics such as zinc chloride (5 to 8 per cent.), tannic acid (20 per cent.), alum (14 per cent.) or ferric subsulphate, mechanical depression of the gingivae may be obtained by using cotton thread, or dental floss rubbed between the fingers, picking up cotton-wool fibres. One of these may be looped around the tooth, pushed below the gingivae and left there during the taking of the impression. Chemical cautery is obtained with 40 per cent. zinc chloride, sodium sulphide or potassium hydroxide or one may use a scalpel, electric cautery or cold cautery. The vaso-constrictors suggested are 1 per cent. adrenalin chloride and ephedrine sulphate 3 per cent.

The impression armamentarium consists of large hydrocolloid syringes and small

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* The following is a simple method for obtaining an accurate wax pattern of a pin hole:—A pin or post hole of any shape or depth, but obviously without undercuts, is prepared and soft wax forced as far as possible into this hole, then a pointed instrument that fits within the hole is heated over a flame, so that the hottest section of the flame is at least one half inch from the end of the point. As wax flows away from the point of greatest heat, when the heated instrument is pushed through the wax already in the mouth of the hole, it melts the wax which flows into the depth of the hole, and by adding more wax and repeating the process a far more accurate pattern is obtained than by using metal, nylon, or acrylic ready-made pins. An accurate wax pattern may thus be taken even of a root canal 10 mm. or 12 mm. deep.

syringes, preferably covered in rubber to insulate them and to prevent burning the patient; hydrocolloid cartridges to fit both (or the smaller ones may be filled from the large ones); water-cooled trays and some form of thermostatically controlled water bath to condition the hydrocolloid. The purpose of a conditioner is to maintain the hydrocolloid at approximately 140 deg. to 150 deg. F. — its optimum temperature — after the material has been liquified in boiling water for eight to ten minutes depending on the maker's instructions.

This is the only means by which the material can be so prepared as to give consistently accurate results, and moreover in this technique in which two impressions are taken, the one immediately following the other, it can be seen that it is of great advantage to have more than one syringe of hydrocolloid ready at the same time.

With a water bath, it is quicker and more accurate to take two impressions at the one appointment than to use one impression either to make two models or to make a die from the section of the impression that contains the abutment, and then later to pour the rest of the model with a second mix of stone.

A suitable water-cooled tray is selected and compound stops placed away from the working area both to prevent the operator from compressing the material as it gels and also to keep the bulk of the material over all occlusal surfaces. Ensuring that all margins of the cavities are visible, the mouth is washed and dried; the impression tray is filled with hydrocolloid and kept in the tempering bath. The small syringe is used to inject into the deep portions of the preparations and gingival crevices, gradually filling the occlusal surfaces and drawing the point of the syringe in such a way as to ensure an even distribution without trapping air. The previously filled tray is taken from the tempering bath, the surface scraped and immediately placed in position and held there for five minutes under a continuous flow of water at approximately 70 deg. F., commencing the flow when the tray is seated. Iced water is suggested by some to hasten gelling but such gross changes in temperature produce dimensional changes. Over a small range of temperatures, say from mouth or chilling temperature to room temperature, imbibition of water counteracts the thermal contractions. The impression is removed, not by the metal handle which often causes a minute pulling away from the tray, but by getting the fingers over the rolled edges of the impression and giving a sharp tug.

The impression is thoroughly washed, excess water and debris removed and it is then placed in a 2 per cent. potassium sulphate solution for three minutes to harden the surface and to hasten the setting of the stone. A thick mix of stone (preferably vacuum mixed) is vibrated into the impression, making provision for a base at least 10 mm. thick. It is then replaced in potassium sulphate. The model should be separated as soon as possible after it has hardened as the exudate may dissolve the water-soluble salts in the gypsum of the stone model and produce a roughened or etched surface.

The procedure of taking the impression is repeated and an opposing impression is also taken in hydrocolloid. The pontic colour and characteristics are noted.

This technique is essentially a precision technique and attention must be paid to the details of each step. One of the models is kept as a master and the other is split into the individual preparations for ease in waxing up. The master and the opposing models are articulated by means of a bilateral wax bite. The exact copy of the margins of the cavity and the accessibility of the entire preparation makes it possible to wax up a pattern with a degree of ease and perfection that cannot be attained in the mouth. The assemblage may be carried out with assurance of a fit when placed in the mouth.

The next task is the fabrication and selection of the pontic. The design of the pontic is extremely important in any bridge work. To be acceptable it must be functional, hygienic, comfortable, aesthetic and biologically acceptable to the tissues. To fulfil these requirements in this case we need a combination pontic of fused porcelain and gold. The anatomy of the cingulum area of the lateral which we are replacing can be faithfully reproduced in gold. Too often this is neglected when replacing an upper laterial incisor tooth, and as a result the periodontal health of the lower incisor is jeopardised.

To facilitate the hygienic requirements of the pontic the lingual embrasures are widened by narrowing the pontic mesio-distally in its lingual half. Because the upper ridge shrinks bucco-lingually during the healing processes following extraction, it is also necessary that the pontic be made narrower in this dimension in order to avoid creating food pockets at the point where the pontic and ridge meet. Due to the aesthetic demands in this area the opening of the inter-dental space to any great extent is limited. However, the dangers arising from this are greatly

minimised by the accessibility of this area to the tooth brush. Variation in the amount of resorption which occurs in a ridge following the extraction of a tooth must be carefully noted, for the alignment of the facing is largely dependent upon this factor—in other words, the greater the resorption of the labial plate of bone the more will the gingival portion of the facing be depressed lingually. Failure to make such depression will result in a pontic which has the effect of being either too long or too short. If the labial surface of the pontic is placed in the same labial plane as the natural tooth the pontic will extend too far gingivally on the labial, making the tooth look much longer than the tooth it replaces. When the neck of the tooth is depressed too much at the gingival, the general effect is that of a foreshortened tooth, and, in addition food will catch in the gingival region.

The aesthetic factors are sometimes improved by the use of stains, or by placing irregular markings on the facings. Wide teeth may be made to appear narrower by converging their labial surfaces medio-distally and by rounding the distal and sometimes the mesial angles of the incisal edge. On the other hand, a narrow tooth may be made to appear wider by flattening the labial surface and extending the incisal edge in a straight line to its full mesio-distal width. An unnecessary display of gold along the incisal edge is one of the most frequent offenders against an aesthetic appearance. Although it is desirable to have the incisal edge protected by gold to prevent fracture of the facing, this incisal extension of gold may be made effective, yet invisible, if it is so bevelled that it does not reflect the light in an incisal direction. As a general rule it is found that a pontic of a shade slightly darker than the natural tooth is less noticeable than one a lighter shade. Similarly, a tooth that is slightly wider than the natural tooth is less noticeable than one that is narrower.

To be biologically acceptable to the tissues, that portion of the pontic contacting the tissues must be properly contoured and constructed of highly glazed porcelain, so that its surface is smooth and impervious to fluids and bacteria. The contour and relationship to the ridge must not allow any food locks in the gingival region either on buccal or lingual surfaces. Where a correct relationship of the contour of the pontic to the gingival ridge exists, the tissues respond so favourably that in many instances it has been observed that the mucosa in contact with the gingival portion of the pontic develops what appears to be a normal free gingiva around the periphery of the pontic. This does not occur if the pontic is not properly glazed, or if it lacks the correct physiological compression of the mucosa, or if it is improperly contoured.

In such a bridge as we are discussing, if the ridge is healed, it is advisable to use a ridge lap or so-called saddle type pontic.

For aesthetic reasons the pontic must contact the ridge along its labial margin. From this line of contact the surface of the pontic follows the ridge downward until it reaches the highest point of the ridge. From here it continues lingually, assuming a definite spheroidal form, and opens onto the lingual as a convex surface. Mesio-distally the contact between the porcelain and the ridge surface is not a complete or continuous one. There is a small narrow contact area extending from the labial margin towards the lingual, but from the contact the porcelain slopes away from the ridge tissues into the mesial and distal interdental spaces.

When a bridge is inserted immediately after an extraction we employ a conical porcelain tip on the pontic, observing the same principles of labial alignment as were noted earlier. The porcelain pontic is extended into the alveolar socket of the extracted tooth to a depth equal to one quarter to one third of the length of the crown. Nothing is gained by extending these porcelain tips far into the socket, since the bone in the healed socket terminates about 2 mm. from the apex of the porcelain. In shaping the porcelain tip the apex of the pontic should lie in the long axis of the tooth, i.e., it should not be brought out labially. In fitting a cone tip pontic immediately after the extraction of a tooth, under no circumstances must it be allowed to come in contact with the alveolar process. The only point of contact between the porcelain and the tissues should exist between the porcelain and the free gingiva. Even here the peripheral outline of the pontic is made smaller than the circumference of the gingival tissues before the natural tooth was extracted, for, whilst the porcelain is in contact on the labial, it is so shaped on the lingual that a space approximately 1 mm. in width is left between the gingivae and the porcelain. This disappears when the socket heals and the tissues again contact the cone tip. This method prevents the gingivae on the labial from moving apically during the healing process.

While we do not have at our disposal the variety of pontics available in the United States of America we can with a little extra time and patience "custom build" our own pontics to fulfil these various requirements.

We can use a NEW HUE tooth of suitable shade and mould. The pins are dissolved in aqua regia, the tooth hollow ground, grooved perhaps above and below the pin holes (depending on size) and a porcelain cervical tip built on. The retention for this facing is obtained by casting into the pin holes. Similarly a Steele's Facing can be used with a porcelain cervical tip baked on to it and a gold backing cast. The pontic is held in the desired position on the master model with sticky wax or PLASTICINE and a keyed labial plaster matrix constructed to hold its position.

The inlay in the central incisor and the veneer on the cuspid are now waxed up, sprued and cast. This waxing up is done on the individual dies made from the sectional model, returning them to the master model to check occlusion and contact points. After carving the patterns to the correct anatomy and making the desired recess for the stress-breaker attachment of the pontic, the surface of the wax is smoothed and polished. This helps in detecting any flaws which may go unnoticed in a poorly finished pattern.

Spruing is an important part of casting technique. Too thin a sprue will result in "shrink spot" porosity or pitted castings. In centrifugal casting a thick sprue is desirable. We use sprues varying from 12 to 18 gauge. "Shrink spot" porosity will also result when a bulky section of a casting is separated from the sprue by a thinner section. For this reason the sprue should always be attached to the thicker portion of the pattern. The sprued pattern should be adjusted in the crucible former so that there is not more than a quarter of an inch separating the bottom of the casting ring from the nearest part of the wax pattern—this allows the air in the mould to escape ahead of the molten metal. This factor is especially important in vacuum investing as the denser investment which results from this technique impedes the escape of the air. Just before investing the pattern should be cleaned with 50 per cent. mixture of green soap and hydrogen peroxide, then sprayed with water, dried with a soft current of air and finally painted with a surface-tension reducing agent.

There are numerous methods of investing and casting—all aimed at compensating for the shrinkage of the metal being cast. The work of Moore would indicate that, with the exception of pure gold and some of the soft inlay gold alloys (e.g., 22K dark gold alloys), it is not necessary to vary the expansion to compensate for the shrinkage of the different inlay gold alloys on the dental market. In the past a combined compensating expansion of 1.25 per cent. was recommended, but Moore and his co-workers have been unable to fit a dental inlay casting to a steel die with this expansion. Apparently a combined expansion of at least 1.50 per cent. is necessary to compensate for the casting shrinkage of the available inlay golds. Hygroscopic expansion, when taking place at 98 deg. F. to 100 deg. F. will compensate for casting shrinkage; the shape of the wax pattern has no influence on the amount of expansion required.

Though some will disput it, we feel sure that vacuum investing procedures produce a much higher percentage of nodule-free castings than do the usual methods of investing. Vibration during the evacuation helps with the elimination of the air, but mechanical stirring under vacuum is much more effective.

The smoothness of the surface of the casting depends upon the smoothness of the surface of the investment and possibly to a limited extent, on the type of gold used and the casting force. Investments start to decompose at about 1000 deg. F. and plaster of paris to change into lime and oxides of sulphur. This decomposition may produce roughness on the mould surface and hence on the surface of the casting. Investments should never be heated any higher or any longer than is necessary. A technique which can offer reliable compensation without heating the investment above 1000 deg. F. is desirable. The technique we employ is that of hygroscopic expansion at 98 deg. to 100 deg.. F., wax evacuation and low heat casting at a carefully controlled temperature.

Dental golds are often described in a general way as being soft or hard, low fusing or high fusing, tough or ductile or springy, in an attempt to convey a picture of physical characteristics in terms that are easily understood. All descriptions of this kind are obviously relative to certain standards which may or may not be commonly known or accepted—hence such definitions are indefinite at the best, and can be completely misleading. However, better means of describing the physical characteristics of dental gold alloys are available. Standardised tests have been developed for measuring their properties accurately. To us, these figures provide a reliable means of comparing one alloy with another and of selecting the most appropriate type of alloy. To use these figures intelligently an understanding of each physical property is necessary. We will try to interpret the most important on this basis.

Proportional limit (expressed in lbs. per sq. in.) is the maximum load that will cause no permanent bend or deformation. It is there-

fore a measure of useful strength. A high proportional limit is desirable for bridge abutments and all other appliances that must maintain their shape under service stress.

Ultimate tensile strength (lbs./sq. in.) is a measure of the load required to cause actual breakage.

Brinell hardness is a measure of resistance to indentation, and is expressed in its own scale of numbers—the higher the Br. number the harder the alloy. This property must be considered carefully in selecting golds for bridges because it indicates how the alloy will stand up under occlusal stress.

Elongation is the amount an alloy can be permanently stretched after it has been loaded to its proportional limit and *before* breaking. It is expressed as a percentage of the original length of the test specimen. In bridge golds elongation is a measure of the amount a gold may be burnished. If the previous properties of a selected alloy are good, then the elongation will be poor, hence our casting for bridge abutments *needs to be accurate.*

Flexibility is a measure of the rate at which a material is bent out of shape under stress, at stresses up to its proportional limit. Since the numerical value for flexibility is very nearly constant for all gold alloys, it is generally omitted from tables of physical properties.

Resilience is the capacity of a material to absorb the energy of applied loads. For example, a particular bridge made of a highly resilient material such as gold will absorb a large part of the shocks and stresses of mastication, while the same appliance made in a less resilient material will transmit such shocks to the abutment teeth. Obviously more resilient materials are to be preferred for all restorations that are supported on abutment teeth.

The numerical value for resilience is derived from the values for flexibility and proportional limit. Since flexibility is very nearly constant, the relative resilience of gold alloys is indicated by the values for proportional limit. This being the case, separate numerical values for resilience are seldom given in physical property tables.

Melting range (degrees F.) is valuable as a guide in determining the proper or safe gold solder to use with a casting, and in judging the ease with which a gold alloy can be melted for casting.

Specific gravity (grams/c.c.) is a measure of weight/volume. In comparing dental golds it is of interest chiefly as it affects the cost of a restoration.

To assist us in selecting suitable alloys, the Bureau of Standards, in co-operation with manufacturers, has classified inlay castings golds into three general types: A for soft, B for medium and C for hard. The C types have a high Brinell hardness (90-140); their tensile strength and proportional limit are the highest and they have low elongation values. Hardening by oven cooling decreases their ductility markedly. Obviously they cannot be burnished in the mouth, but these are the alloys suitable for our use.

Reviewed briefly, our technique is as follows: the correctly measured quantities of investment and water are mixed under vacuum and whilst still under vacuum, vibrated on to the pattern. The inlay ring is then immersed in a bath of water, the temperature of which is kept constant at 98 deg. to 100 deg. F. for the next 30 minutes. To utilise the low heat casting technique we need to evacute the wax prior to inserting the mould in the furnace as it requires an excessively long time to remove the wax at a temperature of 800 deg. F. In order to do this the sprue is removed without detaching the crucible former. A vacuum attachment is applied to it and both are placed in a pot of boiling water so that the crucible former is completely covered. Boiling water is sucked through the investment material. This ensures complete elimination of the wax in three to five minutes, depending on the type of wax and the size of the pattern. The assembly is removed from the boiling water, the crucible former detached, the flask rapped sharply on the bench several times to displace any loose pieces of investment and placed in a preheated furnace at 750 to 800 deg. F. From half an hour to an hour allows sufficient heating, depending on the size of the flask.

The gold may be heated to a molten condition either by direct contact with a blow torch flame, or in the de-oxidising atmosphere of a carbon crucible as in the JELENKO THERMOTROL casting machine. Blow torch melting is the older method and is not so well controlled as regards temperature and oxidising conditions. The flame of the gas-air blow torch is several hundred degrees hotter than the temperature at which the gold is ordinarily cast. This means that the surface of the molten button may be very considerably

hotter than the underside in contact with the crucible. Again, if the flame is not properly adjusted it might oxidise the baser metals in the gold, causing defects in the casting. For a properly adjusted gas-air torch, the core of the flame should have a distinct greenish blue colour. The flame should cover the button of gold but still be held far enough from it that the greenish core in its interior does not touch the gold, lest the temperature fall. A good grade of flux should be used in melting. The temperature at which the metal is to be cast depends entirely upon the operator. Since this temperature is important, blow torch casting is apt to be uncertain when done by an unskilled operator. Properly adjusted, the THERMOTROL machine indicates the temperature of the molten metal at the instant it is thrown into the mould.

There is an ideal relationship between the temperature of the metal and the temperature of the mould for a particular alloy. This has an important influence on the excellence of the casting. Casting into too hot a mould gives a very coarse grain, and consequently a weak and brittle dendritic structure. A much finer structured gold and a tougher one is obtained by casting the same alloy into a mould at a lower temperature, causing it to cool more rapidly through its liquid phase. The force with which the metal is thrown into the mould is also important. This factor is probably related to turbulence and resulting entrapped gases. Strength and ductility decrease quite sharply when force is varied from the optimal. Whatever the method of casting employed, it is important not to remove the casting ring from the furnace until the very last minute. The machine must be set, the gold molten and then the ring quickly taken from the furnace, placed in position and the casting made immediately. An inlay ring on removal from the furnace at 800 deg. F. falls in temperature at the rate of 50 deg. F. per minute when an asbestos liner is used and 100 deg. per minute without one. The hot ring is plunged into cold water as soon as the button is black.

Care must be taken in pickling, that the acid is clear. An acid containing copper salts from previous use in pickling is very apt to contaminate the surface of the casting with copper deposits. This will lead to future discolouration of the appliance in service, particularly if the surface contains minute pits. Pickling techniques vary—some heat the inlay to a dull red heat and quench in either 50 per cent. hydrochloride or sulphuric acid. This is dangerous as it can cause warpage of large castings, but more so because small particles of investment adhering to the casting when it is heated, break down and liberate sulphur which reacts with the alloy forming compounds, which the pickling will not remove.

It is advisable therefore after quenching to brush the casting as clean as possible, soak in hydrofluoric acid to dissolve any silica particles remaining on it, and then boil in the 50 per cent. acid solution.

The sprue is removed and the casting finished with burs, stones or rubber wheels. The marks left by the preceding coarser tool or abrasive should be removed by the next finer tool or abrasive. The final polish is not yet applied.

The inlay and veneer are then placed in position in the master model and using the hand-piece in a parallelometer, the recess is trimmed for the stress-breaker attachment so that it is more nearly a precision slot, serving to lock the bridge and only allow movement in an inciso-gingival direction, parallel to the path of withdrawal of the cuspid veneer. If this is not done and an inaccurate rest put in the inlay, in time the torque will force the central incisor bucally.

The facing is now placed in its correct position on the master model, using the plaster matrix, and a backing is waxed up and cast. As we have already pointed out, we must ensure that there is functional contact on the cingulum area of the backing. When the backing is cast, pickled and cleaned it is positioned with the facing and castings on the master model, attached to the veneer with sticky wax and the two are withdrawn and soldered.

After soldering the castings are again soaked in hydrofluoric acid to remove the investment. The acid is washed off and the whole is cleaned ready for final polishing. Before polishing the gold should be heat treated according to the manufacturer's directions. The final polish is applied with rouge on a dry chamois buff. The bridge is now ready to be inserted.

We prefer to anaesthetise the teeth involved before removing the temporary dressings, as cavity toilet and cementation can be quite painful. The outside surfaces of the castings near the margins are lightly coated with VASELINE so that the set excess cement will later come away easily. The bridge is cemented into place as a unit, ample time being allowed for the cement to set. The cement is chipped off and the patient shown how to clean the restoration with the tooth brush and floss silk.

Oral Surgery for the General Practitioner*

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It is not the intention of this paper to convey to you the surgical procedure in intimate detail for every condition found within the oral cavity and its associated structures, but rather to place before you the fundamental principles of oral surgery which will assist in performing the simpler and more common conditions which present in general practice.

To attempt to give a detailed plan of treatment for all conditions encountered in the oral cavity would, as you can readily understand, be impossible, indeed foolish, and it is for this reason the contents of this paper will only endeavour to provide you with the fundamentals of surgery, treatment, and post-operative care which will enable the general practitioner to carry out the simpler cases of oral surgery with which he comes into contact from time to time.

Oral surgery may be conveniently grouped into three sections, namely pre-operative, operative and post-operative. Each of these sections should be given your most earnest and expert attention to obtain results from your surgery with which you will be pleased. You must not, under any circumstances, become so enthusiastic about the surgery itself that you overlook the other two very important sections — the pre-operative and post-operative.

I. The *pre-operative* section of your work should include firstly, your examination of the patient. This examination should not take the form of a cursory glance within the oral cavity by the operator nor be restricted to an investigation of the complaint needing immediate attention. The examination should be searching and thorough, and should not be confined to the localised area but include also general characteristics and abnormalities. It is well to remember at all times that most oral lesions are an indication of some general disturbance, or are themselves foci producing some general disturbance.

As the examination proceeds all the data and information should be recorded on the patient's chart which becomes the case history of the patient for future reference. Do not go to the trouble of obtaining all this information and neglect to record it on paper. To make a mental note of it is of no use whatsoever.

The essentials of the examination should include:

Name. Age. Sex.

History of previous and present illnesses.

History of present conditions which in itself should contain signs and symptoms of the disorder. In dealing with symptoms, which, as you are aware, are the subjective conditions or findings observed by the patient, it is well to remember that they vary from patient to patient, vary from time to time during the course of the disorder, and also that they may be a "referred" pain from the complaint in question.

The history of the complaint should also contain the alleged cause, that is, whether it was caused by injury (traumatic), irritation, infection, etc. It should also include data on the duration of the complain and its course and previous treatment. Many patients are reluctant to discuss this aspect with the operator, but it is necessary to attempt to obtain such information if it is suspected that the condition has been treated previously.

Pre-operative X-rays, and a study of same, are of course essential, particularly for conditions of the osseous structure, though X-rays must not be confined to conditions of the deeper structures. Some soft tissue lesions may be caused by an irritation of those soft tissues by a condition, e.g., a retained root lying in the deeper structures.

In some of the conditions of the bony structure, for example, cysts, it is well to compare the relative anatomy of the right and left sides radiographically. This is particularly so in the maxillae in the region of the maxillary antrum.

Your X-rays also are extremely useful to localise the area you wish to operate on, especially so in the smaller areas in the bony structure. Retained roots, for example, may be located in their exact position by the use of a small intra-oral film, a holder for that film which also serves as a probe or marker, and a flexible millitmetre rule.

The technique is to estimate where the area is, from the mid-line of the maxilla or mandible, mark it with indelible pencil, measure this distance from the mid-line to the pencil mark and record it. Then place the X-ray film in the holder with the probe corresponding to the pencil mark, and expose the film. Any variation in the position of the area to probe, which shows as a white line on the film, may be added or subtracted, depending on whether the area is mesial or distal to the probe, from the original measurement already noted. This simple procedure may save a great deal of operation time, and also a great deal of worry, in locating the area.

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With any soft tissue lesion it is well to consider the history and clinical appearance of the lesion. Where some doubt as to diagnosis exists such as tumours, cysts, ulcerations, soft tissues, hyperplasia, the advisability of a biopsy must be considered before operation.

From a study of the foregoing facts, that is the general condition of the patient and the type of operation to be performed, we are then in a position to consider such things as:

(1) Use of chemo-therapy.
(2) Use of premedication.
(3) Type of anaesthesia.
(4) Hospitalisation of the patient.
(5) Co-operation of other operators.

The use of chemo-therapy of course depends on the case in question, but is of particular used in prophylactic doses in patients with a chronic infection, a history of rheumatic fever, or in cases of large haematomas, osteomyelitis, etc.

Premedication used in conjunction with local anaesthesia is a great aid both to patient and operator. Generally 1½ to 3 grains of NEMBUTAL or SECONAL, according to the age and weight of the patient, will suffice to produce a quiet, relaxed, and co-operative patient. Premedication for general anaesthesia is, of course, left to the discretion of the anaesthetist.

The type of anaesthesia chosen is closely related to the age, general condition, type of patient, and the surgery to be performed. Most simple operations may be performed under local anaesthesia, as also may many large and prolonged operations with the aid of conduction anaesthesia in both the mandible and maxilla. However, some patients insist on general anaesthesia; some are bad subjects even with the aid of premedication for local anaesthesia. If general anaesthesia is to be used, it is essential a Magill's tube be passed to enable the throat to be packed with gauze.

Hospitalisation of the patient follows on a consideration of the patient's general condition and is linked with such factors as:

Type of anaesthesia.
Extent of operation.
Type of patient.
Possibility of prolonged and complicated post-operative treatment.

Co-operation of other operators is dependent upon the plan of treatment. All operations should be well thought out and planned before operation, with consideration given to possible complications and co-operation of all associated with the operation. This co-operation is especially essential in the construction of immediate dentures. Here it is necessary to have close co-operation between surgeon and prosthetist. At other times it is decidedly an advantage to have the co-operation of the patient's medical adviser in the pre-operative stage.

Finally it is essential to discuss with the patient before operation the suggested procedure and also the possible complication, if any, that may be expected, remote or otherwise. Such procedure is assuring to the patient, giving to him a sense of feeling of security in the capabilities of the operator. How much easier, for the patient and operator alike, if the possibility of a nerve involvement with resultant prolonged anaesthesia is foreseen and explained before operation.

II. The second section of the paper, viz., *operative*, covers a very wide field, for it is here that the operative technique for the case in hand is carried out. It is the intention of this paper to set out the essentials of all surgery and to describe briefly the technique for some of the most common cases met with in everyday practice. It is essential for those who contemplate doing any surgery, no matter how small, to be adequately prepared to carry out the work capably and efficiently.

The operator should see that his assistant is trained in the art of assisting—you notice the expression art, for it is a true art to be a capable assistant. It is well to remember that an efficient assistant who knows what to do at the right time, one who can anticipate the operator's next need, and one who knows how to do it, not only saves much operative time and helps the patient to have confidence in the operator, but also helps eliminate many undesirable post-operative complications such as excessive oedema caused by indiscreet or heavy retraction of the tissues.

The surgery itself should be equipped for surgical operations. Remember, it is essential to observe a strict aseptic technique and to do this, all linen, swabs, and applicators, etc., must be autoclaved in conjunction with the usual observance of asepsis with the surgical instruments. Surgery carried out under aseptic conditions will be a revelation in regard to post-operative treatment; in most cases there is an uneventful post-operative healing.

The surgical instruments themselves should be set out and kept conveniently ready for use. A convenient method of doing this is to have the instruments set out on trays suitably draped with sterile towels. Each tray should contain these essentials:

Lip and cheek retractors
Scalpel
Periosteal elevator
Flap retractor
Bone chisel and mallet

Bone rongeurs
Bone file
Fine tissue forceps (McIndoe)
Dissecting forceps
Needle holders—suture needles
Scissors
Sterile towels for draping the patient
Sterile rubber gloves
Sterile bone drills.

Any other instruments for any type of surgery may be kept on a separate tray and lifted off as required.

In addition the facilities of an efficient aspirator (or sucker) should be at the disposal of the operator, for it is impossible to work efficiently when you are unable to see what you are doing. In other words the surgeon should have a bloodless field to work in. At the same time the need for the exclusion of saliva from the wound should not be overlooked.

In any surgery within the oral cavity the following steps in technique will apply:

First of all drape the patient in sterile towels or drapes of choice so that the surgeon has a sterile field around the patient's head, face, and chest. Prepare the tissue within the oral cavity and isolate it with gauze to prevent contamination by the tongue or saliva. Retract the labial and buccal tissues with retractors so that the operator has a clear and unobstructed view of the area he wishes to work upon. With judicious placement of the retractors this may be accomplished at all times. Design the line of incision to give the operator adequate access, to prevent undue trauma to the flap of muco-periosteum and to allow the flap, when the operation is complete, to be returned to accurate position with the margin resting on and overlapping normal bone.

It is, or has been, a practice by some operators, especially to recover the root of a fractured tooth, to make one vertical incision along the centre of that root and reflect the tissues to either side. This practice, as one can readily visualise, will not under any circumstances, if the buccal bone overlying the root has been removed, allow the margins of the incision to be returned to place and overlie normal bone; in fact, they will be lying over the cavity which has just been produced by the removal of the bone. To many, the design of an adequate "flap" to allow this ease of access seems radical and unnecessary, but I can assure you it is not, and the resultant post-operative improvement is well worth adopting the principle.

Remember at all times to allow for a good blood supply and resultant nourishment of the tissues included in the flap.

Having designed the flap, incise the tissues, so that with one decisive movement of the scalpel all of the tissues of the flap of muco-periosteum are included. Be very careful to make sure that the periosteum is incised, for if it is not the lifting of the tissues away from the bone will become a difficulty instead of an easy procedure.

Try to avoid as much as possible multiple movements of the scalpel along the incision line as this produces a ragged edge to the flap. At the same time extend the incisions from the alveolar crest or ridge to the buccal sulcus, far enough to allow the tissues to be reflected in such a manner as to, again, allow ready access to the area and prevent the tissues being traumatised.

Once satisfied with the design and execution of the incision, proceed to raise the flap of mucco-periosteum away from the underlying bone with the aid of fine tissue forceps and periosteal elevator. Should you prefer to substitute a chisel for the periosteal elevator, great care should be exercised not to traumatise or tear the tissues.

If the periosteum has been included in your line of incision with the scalpel, the tissues should elevate or roll back without any undue force or levering.

Once raised, the flap is held away from the area with the aid of a flap-retractor, once more to allow ease of access, clear vision, and prevent traumatisation of the tissues. At the same time remember careless or injudicious use of the retractor may injure the tissues. At this stage the removal of the outer plate of bone necessary for the removal of the area within the bone, whether it be cyst, retained root, etc., may be carried out with sharp chisels and mallet or bone drills.

If using bone drills, remember it is necessary, to prevent overheating and burning of the bone, to play a stream of saline on to the bone. With chisels care should be taken not to use excessive force to the blow of the mallet. It is most uncomfortable to the patient and poor technique. In the maxillae it is, in most cases, better to hold the chisel parallel to the axis of the root of the tooth. In the mandible at all times the direction of the chisel should be parallel to the body of the mandible.

Sufficient bone should always be removed to allow removal of the area without undue force, for with any removal of bone it necessarily follows that the remaining bony structure is weakened at that point. Having removed the lesion, all sharp bony edges of the cavity should be removed and smoothed with rongeur forceps and bone files until the cavity is dish-shaped.

All debris, bone chips, should then be removed with forceps and by wiping the cavity with

a gauze swab moistened with saline. Pay particular attention to small bone fragments beneath the flap, for if these are left they will act as a foreign body and delay healing. The next step is to control all bleeding points. This may be accomplished by:

(1) Positive pressure by a gauze swab held in place by a finger or tweezers.
(2) Application of gauze soaked in very hot saline—be careful to confine the gauze to the area in question.
(3) Use of cautery.
(4) Ligation of vessels within the soft tissues.
(5) Use of absorbable gauzes or sponges.

Once satisfied that the bleeding points are controlled, the flap of muco-periosteum may be sutured carefully and accurately back into position, generally with interrupted cat-gut sutures, though at times continuous gut sutures may be used as also may nylon sutures. If using nylon sutures be sure to note the number of sutures used and to see that the same number are removed. I say this because nylon is very well tolerated by the tissues and the epithelium will even cover the sutures.

Such a technique may be used for the removal of teeth which may otherwise be difficult to extract with forceps, fractured teeth, retained roots, small cysts, etc. in the maxillae or mandible.

One variation in flap design in the mandible that I feel should be mentioned is the design for the flap for a lower third molar. Here the distal incision which normally would extend from the crest of the alveolar ridge to the muco-buccal fold varies in that it extends from the distal of the lower second molar, bisects the retromolar triangle formed by the external and internal oblique ridges and extends up the anterior border of the ramus. This incision allows good access to an otherwise difficult area but at the same time guards against involvement of tissues and structures on the pharyngeal side of the ramus.

Of the soft tissue lesions with which the general practitioner comes into contact most, I think the fibrous hyperplasia or fibrous hypertrophy of the tissues is the most common. This lesion is most commonly found in edentulous patients with a history of ill-fitting dentures. As with all soft tissue lesions, the area must be entirely removed, and the following method ensures that this is done:—

The area of the tissue is grasped at either end with forceps which will stay locked. The fold of tissue is then bisected through the centre down through abnormal tissue to normal tissue. The fold of tissue is then in two halves, each with a base of normal tissue. Each half of the tissue may then be removed separately. It is common with this particular surgery to have a considerable number of bleeding points which must be controlled by one of the methods mentioned previously. To guard against post-operative bleeding, the margins of the wound should be approximated with interrupted cat-gut sutures. These sutures should be released forty-eight hours later to prevent the elimination of the buccal sulcus, as in most cases after suturing, it will be found that the labial or buccal tissues are close to the crest of the alveolar ridge.

In deep large bony cavities, particularly in the mandible, it is advisable to mix in with the blood clot, before suturing, one of the bacteriostatic agents in powder form. Be careful to mix the powder and not place it in the cavity in one solid mass, as in some cases this may act as a foreign body.

On completion of the operation, record in detail the operation including instructions given for post-operative care.

Particular care should be taken to see that any soft tissue lesion removed is placed in formal-saline and sent for histopathological examination.

III. The *post-operative* treatment and care of the patient is as important a section as the surgery, for it is upon your observations that the operation is carried to a successful conclusion. The patient should be seen twenty-four hours after operation and examination made of pulse, temperature and respiration rate. The wound itself should be irrigated with normal saline and the mouth generally cleaned.

The general condition of the patient should be examined, noting:—

Swelling, external or internal.

Comfort of the patient in relation to the surgery.

Diet. Some patients neglect to take adequate nourishment after surgery.

Bowel movements.

With any excessive post-operative bleeding and resultant haematoma consideration should be given to instituting a course of chemotherapy. Remember a haematoma is a stagnant area of blood and is very prone to infection.

In general if the surgery has been performed carefully and aseptically the results of the surgery will be most gratifying. The patient will in most cases present with little swelling, a clean healthy wound, and report that he or she has had a comfortable night.

Observe the patient at regular intervals until the wound has completely healed and where necessary take post-operative X-rays

(e.g., cystic cavities) at intervals up to twelve months.

With any persistent drainage a specimen should be sent for bacteriological examination to determine the causative organism and subsequent treatment.

From this summary of general surgery I hope some of you have gained something, and I shall conclude by saying that successful surgery results from the operator making adequate preparation, having adequate facilities and being adequately aware of his own capability and limitations.

The Use of Platinum and Porcelain in Dental Restoration*

Theodore H. Perlman, D.M.D.

Introduction.

It is hard to understand why the two finest materials known to the dental profession for years have received such little recognition in restorative dentistry. Porcelain and platinum have all the characteristics, qualifications and specifications for the ultimate in restoring tooth structure. They are the two materials most compatible to dental tissues; they have the longest life, withstanding the wear and changes in the mouth better than any other materials; and they are the most cosmetic.

Platinum was first used in 1890 in dental amalgams and later in denture construction. In the early 1930's a technique was developed for bridge construction, using swedged and braized platinum as the core over which porcelain was baked. The technique was difficult and proved unsatisfactory because of breakages both in baking and also after placement in the mouth. This was primarily due to lack of wedding of porcelain to swedged or braized platinum and also to the wide differences in expansion and contraction. However, with cast platinum there is the phenomenon of a semi-wedding to baked porcelain and, for all practical purposes, it has similar coefficients of expansion and contraction as baked porcelain.

Attempts were made in the 30's to cast platinum with accuracy, but most all failed. Today any dental restoration can be made with platinum and porcelain, with assurance of success.

The selection of the type of restoration which is to be built depends upon the bite. If space is not present to allow for a sufficient thickness of porcelain, then a veneer crown is indicated. If the space is comparable to the thickness required in a porcelain jacket crown, then the coping type abutment can be used.

One of the problems in a full veneer restoration is the opacity of the full metal background. The reflection of certain angles of light will produce a dark shadow. This cannot be avoided in the anterior region of the mouth, because the anterior teeth are placed in the arch on a segment of a relatively small circle: the posterior teeth are more on a straight line. Also, the anterior teeth are completely exposed during certain movements of the lips and any decided refraction of opacity can be quickly detected.

Nevertheless, in close bites the full platinum and porcelain veneer crown must be used and will give a more satisfactory result than any other material. The coping type bridge abutment will give the full refraction of light similar to a porcelain jacket crown and is indicated for a better cosmetic result.

The impact strength of porcelain is sufficient in relatively thin sections to overcome the normal straight impact blows which occur in the mouth. The resistance of porcelain to a chipping blow is relatively low. This type of impact occurs in lateral or incising movements of the jaw. Due to this property, the incisal margin of anterior veneer crowns should be well protected with platinum so that no margins are exposed to a chipping blow. The coping type is not as subject to a chipping breakage as the veneer, because there are no thin exposed margins.

Breakages in porcelain jacket crowns occur more often because of torque. Torque is produced at the gingival margins, because of the lack of a proper seating and fit. With a coping in cast platinum and porcelain baked directly to it, solid seating is established, thereby overcoming torque. The fact that cast platinum has a semi-wedding with baked porcelain means that the restoration resists any torque as a whole. Therefore, breakage rarely occurs in the coping type crown.

The following describes the construction of an anterior bridge using the coping design as abutments.

Technique.

1. A shoulder or shoulderless preparation is made extending below the free margin of the gingiva. (The properly executed jacket crown preparation is a conservative technique. It is more self-cleansing and destroys less vital tissue than any other procedure. The enamel only is removed. Over-preparation is never indicated or necessary as platinum is amply strong in thin gauges and porcelain does not need heavy thickness for resistance to breakage and wear.)

2. An impression is obtained with inlay wax, using a copper band.

*Read at the 13th Australian Dental Congress, Brisbane, June, 1953.

3. A copper plated die is made, being reinforced and having its root end contoured in low fusing metal.

4. The models are mounted on an anatomical articulator.

5. Platinum foil (.001) is swaged over the crown of the copper plated die, similar to the technique used if a porcelain jacket crown were to be made. This foil becomes an integral part of the preparation and is left in place during the waxing and contouring of the pattern. The reason for the .001 foil is to overcome the shrinkage in the casting process of platinum group metals. There is a shrinkage of .002 in the casting of platinum; .001 is overcome in the investment and heating procedures; therefore, the .001 foil will give a perfect fit when removed from the die after the casting is made.

6. *Waxing*: Any good lubricant and 28 gauge sheet wax should be used. The wax is adapted so that there will be a coping of 2 mm. on the labial, 4-6 mm. on the mesial and distal and extended to cover the cingulum or a little more incisally, on the lingual. It should then be reinforced with blue inlay wax so that a shoulder will exist completely around the gingival, albeit very slight on the labial.

Reinforcement should be added on the surface designed for soldering in the assembly of the bridge. The incisal aspect of the shoulder should be square, as porcelain will finish much better to a square surface than a round. There will then be a slight apron of 28 gauge wax not included in the reinforced wax shoulder, extending towards the incisal. The incisal margin of this apron is then reinforced with blue inlay wax, to give it some body, when removing pattern from die. The gingival margin is sealed throughout, allowing a little excess of wax for finishing purposes.

7. *Sprueing*: Do not use any metal sprues. The pattern should be sprued with ten or twelve gauge round inlay wax at the heaviest point on the pattern.

8. *Mounting wax patterns*: (a) A sprue former is made by cutting an exact half circle of pink base plate wax 2½-inches in diameter, which is then adapted into a cone sealed at the junction.

(b) The wax cone is mounted on a 2½-inches square of 1/8-inch asbestos sheet and the edges sealed down.

(c) The sprue is placed on the former so that the wax pattern is at a distance of at least ¼-inch from the top of the casting ring.

(d) Preparation and lining of casting ring: A stainless steel casting ring 2-inches in diameter and 2¼-inches in length is lined with asbestos strip 1/8-inch thick so that the inside of the ring is covered to within ¼-inch of both ends. The asbestos is adapted to the ring by moistening it with water.

9. *Type of investment and handling*: A variety of investments are available for casting platinum group metals. They are all composed of compounded silicans. The resulting mould must be sufficiently strong to withstand the impact of platinum metals at high temperature, and have sufficient crushing strength to overcome the shrinkage of the metal. It must produce an accurate casting free from all impurities. I have found the *Eljan* Investment meets these requirements.

Because of the heavy consistency of the investment a heavy duty mechanical mixer is necessary.

The mixing of the investment must be carried out with care. The technique described here is that used for *Eljan* investment and assumes that facilities are available for vacuum investing. The binder (2 fluid oz.) is placed in the mixing bowl and 6.8 (avoirdupois) oz. of powder are poured in gradually. This procedure should take approximately five minutes. It is then mixed at high speed for another 10 minutes, when its consistency should be that of a heavy cream.

10. The mix is placed in a large clean rubber bowl and submitted to a reduced pressure. The pattern meanwhile is painted with a good de-bubblizer which is then washed off and the pattern thoroughly dried.

11. The pattern and ring are now placed in the bell jar and investment poured into the ring to a level ¼-inch above pattern. Care must be taken not to trap air. After subjecting the investment to a vacuum the top of the bell jar is removed and the remaining portion of the ring filled. It is then allowed to set undisturbed for approximately one hour.

12. *Heating and wax elimination*: A controlled heating oven and eliminating oven are necessary. The ring is placed, with the base down, in the heating oven at 125 deg. F. for a minimum of three hours (but preferably overnight), after which it is heated to 250 deg. F. for two hours. The asbestos base is then removed and the ring transferred, sprued end down, to the eliminating oven which has previously been heated to 250 deg. F. The oven is then allowed to heat slowly up to 1400 deg. F. after which the temperature is allowed to drop to 1200 deg. F., where it is held for 15 minutes.

13. *Casting machine and crucibles*: Centrifugal casting is necessary. The crucible must be clean and used only for the melting of platinum group metals. At least 25 per cent. more pressure is necessary in casting platinum than gold. The arm must be released so quickly that the metal hits the casting cavity instan-

taneously. Platinum metals chill rapidly and therefore the casting must be accomplished in a flash. The quicker the metal hits the mould, the better the casting.

14. *Heating the metal*: The casting machine is prepared before heating metal. It is wise to use asbestos gloves in this operation and also welders' glasses. The ingot of metal is placed in the crucible, allowing approximately 10 dwt. for the button in excess of the casting and sprues. A gas and oxygen torch should be used which is sufficiently large to produce 4000 deg. F. and which will melt the button within 30 seconds. *Do not use any flux.* Only when the ingot is fluid should the ring be transferred from the eliminating oven to the casting machine.

It is difficult to overheat platinum group metals such as are used in this technique, so there is little likelihood of overheating. The casting machine should spin until it stops by itself. The ring is bench cooled until it can be handled with the bare hands. Then the casting is removed under water and as much of the investment chipped away as possible. The remaining mass is placed in 52 per cent. to 55 per cent. hydrofluoric acid until all investment is removed.

15. *Finishing*: The casting is cut from the sprue with a carborundum disc and the .001 platinum foil removed from the copper plated die, care being taken not to distort it as it will be used again. Any adjustments necessary are made to this casting but the gingival margin is not burnished at this point. The platinum matrix is cut so that it covers the remaining portion of the crown not included in the coping, allowing about 2 mm. to extend below and under the incisal extremity of the coping. It is then placed on the die and the casting forced over it.

The casting is now finished against the die, burnishing the gingival margin and trimming it to the desired extension. The platinum casting shoulder should be finished square and contoured. The incisal extremity of the casting is trimmed and burnished against the platinum foil matrix to the desired length, leaving an apron of 28 gauge platinum metal extending incisally from the metal shoulder of approximately 2 mm. on the labial, 4 mm. on the mesial and distal and covering the cingulum on the lingual. Care should be taken not to polish that part of the casting to which porcelain will be baked but only to clean it well with soap and water. The casting and .001 foil matrix will adhere to each other as they are removed from die and heated in the porcelain oven to approximately 2550 deg. F. to eliminate any remaining debris and to eliminate any internal strains set up during the casting. After cooling they are returned to the die, burnishing the foil wherever necessary.

16. *Baking porcelain*: The ideal porcelain for this technique is still to be developed, but I will describe the procedure for handling *Justi High Fusing* porcelain.

The entire surface, including the foil surface should be made opaque by painting on a thin mix of properly selected shades. The oven is heated in the usual manner to a "very low biscuit," at least 100 degrees below the fusing point of the porcelain. The porcelain should thus be only slightly past the chalky state. After cooling this should be repeated until all the surfaces have a thin film of porcelain sufficient to block out the platinum. There is now prepared a mix of half opaque and half body shade which is placed over the entire surface and burnished until smoth. This layer must be thin. Again the porcelain is heated to a "low biscuit bake" as before.

The entire crown is now built up in body shade preferably using thin bakes a number of times to reach the desired contour. No glaze must appear on any surface. Contour and anatomy are ground in, and areas for the middle third and incisal porcelain are ground out, and the crown then built up. The porcelain is fired allowing approximately 50 degrees more than that used for the opaque bakes. This will give a slight glaze sufficient to bring out colour and will aid in bringing any trapped air to the surface. After checking the contour and anatomy, it is tried in the mouth. All the grinding is completed and after cleaning all surfaces with soap and water, it is returned to oven and glazed.

Checking is due to faulty technique. If any of the first bakes have a glaze the tendency is that the porcelain will check in final bakes. Should this occur all porcelain must be removed in 52-5 per cent. hydrofluoric acid and the porcelain preparation re-commenced. Checking may also be due to contaminated metal or internal strains of a faulty casting.

17. *Bridge assembly*: The type of dummy desired (such as a tube tooth, trupontic or Steeles facing) is selected and the bridge is assembled, soldered and finished in the usual fashion. The only precautions necessary are that the invested case should be heated slowly, using very little flux near the porcelain and allowing the soldered case to cool completely interest in cases of acute infection or when by placing a bell jar over the entire soldering block. After the entire bridge is completed and ready for setting, the .001 foil is removed from each jacket.

18. *Setting*: An oxyphosphate of zinc cement should be used. The colour is tested by mixing the powder with water and trying the bridge in the mouth. A thin mix should be used and no force employed to the seat bridge.

Editorial

This journal is published by the Australian Dental Association (New South Wales Branch), B.M.A. House, 135 Macquarie Street, Sydney. Communications concerning literary matter should be addressed to the Editor and all advertising and business matters directed to the Secretary.

Subscription rate is £1/5/- per annum (Aust.); £1/10/- per annum outside Australia. Single copies, 5/-.

Original communications: Manuscripts should be typewritten on one side of the paper only, with double spacing and liberal margins. Carbon copies should not be sent. References should be placed at the end of the article and should include, in the order given, name of author, title, journal, volume, initial page of article, month and year; e.g., Wallace, J. S.—The newer knowledge of hygiene in diet: Dent. Items Int., 69:38 (Jan.) 1947. References to books should include the following information: name of author, title, edition, place of publication, name of publishers, year and page (if necessary).

Illustrations: These should be kept to a minimum. Suitable captions with number and author's name should be marked on the back of all illustrations. Photographic prints should be approximately 5 in. x 4 in. and printed on glossy paper. Authors unaccustomed to preparing drawings and photographic prints for reproduction are invited to seek the advice of the Editor.

First Dental Seminar of the World Health Organisation

The affairs of the World Health Organisation and in particular, its relations with the dental profession, have a complicated history. Suffice to say that it recognises the Federation Dentaire Internationale as a fully representative international body in the field of dentistry and that, for a period of five months during 1953, it appointed a temporary dental consultant. At other times matters of dental interest are dealt with by the section of Maternal and Child Health. It was apparently through the dental consultant's efforts and those of the F.D.I. that it was decided to hold a seminar on dental health in the Western Pacific area.

It was ultimately arranged to hold this seminar in New Zealand during May of this year. Whilst the administrative details were left in the hands of a New Zealand committee under the directorship of Professor C. L. Bailey, Professor of Education at the Victoria University College, the W.H.O. appointed a faculty of seven consultants to arrange the scientific aspects of the seminar. Those chosen were: Dr. G. Parfitt (England), Prof. K. Shourie (India), Dr. F. Arnold (U.S.A.), Prof. J. Walsh (New Zealand), Prof. G. Toverud (Norway), Mr. J. Saunders (New Zealand) and Mr. C. Mummery (Malaya). The seminar was so planned that, after considering the cause and prevention of dental caries and periodontal diseases, discussion passed on to more specific methods of controlling dental caries such as the topical application of sodium fluoride and oral hygiene. The remainder of the time was allotted to a consideration of dental care as a part of public health services and the training of personnel for such services. Invitations were issued to countries in the Western Pacific, South-East Asian and Eastern Mediterranean regions.

We know all too well that dental diseases are world-wide and it is gratifying to see their prevention being tackled as a world health problem. So large indeed are the problems that they surely warrant the appointment of a permanent dental consultant to the staff of the W.H.O. No one will deny that the closest contact with the medical profession is not only desirable but necessary. However, it is equally important that dental matters should not be left in the hands of persons who, no matter what their medical qualifications, are not qualified to represent dentistry. The effect of the absence of expert dental representation has been seen too often in the health service problems of Australia.

The dental profession will welcome the first step towards placing the prevention of dental disease on a world level and it is to be hoped that the W.H.O. will see its way clear to continue the good work by appointing a permanent dental consultant to their staff.

News and Notes

Distinguished Overseas Lecturer Visits Australia

Mr. Terence Ward, M.B.E.

Through the courtesy and generosity of the Sydney Myer Charitable Trust we have been privileged by a visit from Mr. Terence Ward, M.B.E., F.D.S., R.C.S. (Eng.), L.R.C.P., L.R.C.S., L.D.S. (Edin.).

Mr. Ward completed a week's visit to New South Wales where his activities proved of material benefit to dentistry in this State.

Mr. Ward is a Maxillo-Facial and Oral Surgeon of international repute. He is in charge of the Maxillo-Facial section of the Queen Victoria Hospital, East Grinstead, Sussex (the principal Maxillo-Facial and Plastic Surgery centre in the British Isles), and is a consultant to the Royal Air Force.

In addition to visits to the United Dental Hospital and the University of Sydney, Mr. Ward addressed a Discussion Group at the Dental Hospital on April 29, visited the North Eastern Division of this State Branch over the weekend of May 1 and 2, and addressed a general meeting of members of the Association on May 4.

His clinical knowledge and sound approach to surgical problems, coupled with a facility for public address and a quiet sense of humour impressed all who were fortunate to meet or hear him.

Second Country Convention Orange — September, 1954

Plans are well advanced to make the second country convention of the Association, to be held at Orange from September 20 to 24 inclusive, a most successful function, both from a clinical and social viewpoint.

Dr. Edwin Johnson of Melbourne, who is well known for his able addresses on the subject of prosthetic dentistry has accepted the invitation of the Convention committee to be one of the principal lecturers. Dr. Johnson's talks will be on Full Dentures.

Mr. L. S. Beckett of Sydney will be another of the principal lecturers and he will deal with Partial Dentures. Other lectures are planned on Orthodontia for the General Practitioner, Periodontia, Pedodontia, Preventive Dentistry, and Crown and Bridgework, together with other subjects. These main lectures will be supported by an extensive variety of table clinics, silent clinics and films.

The clinical programme, as it is being established, will consist of a limited number of practical and selected lectures and clinics so as to enable all members attending to benefit from all portions of the programme.

The social and sporting section of the convention is in the capable hands of local committees who assure all attending an ample opportunity of meeting old friends and making new ones, and of enjoying the tourist and sporting facilities which Orange can so readily provide.

The convention commission asks for early application for membership and your early attention to the matter of accommodation so that every arrangement can be made for your comfort and enjoyment.

Fairfax Reading Memorial Prize

The third biennial award of the R. F. Reading Memorial prize will be made this year.

Objects of the prize are:

(1) to afford a means of recognising outstanding dental achievement.

(2) to encourage academic and clinical progress in dentistry.

(3) to perpetuate the memory of the first Dean of the Faculty of Dentistry, University of Sydney—Richard Fairfax Reading.

It is awarded for "original contribution or contributions, or services of outstanding merit, adding to the knowledge or understanding of any subject with which Dentistry is concerned, but shall not be awarded in respect of any material submitted for an academic degree."

Information concerning the awarding of this prize can be obtained from the honorary secretary of the Dental Alumni Society of the University of Sydney, United Dental Hospital, 2 Chalmers Street, Sydney.

Appointment as Chief of Army Dental Corps

Major General Oscar P. Snyder was sworn in as new chief of the United States Army Dental Corps at ceremonies in Washington last month. Dr. Leslie M. FitzGerald, A.D.A. president, was a principal speaker at a testimonial dinner given in his honour at the Officers' Club, Brooke Army Medical Centre, in San Antonio, Texas. The dinner was arranged by the San Antonio District Dental Society and the dental staff at Fort Sam Houston where General Snyder has been director of dental activities.

During the war General Snyder was in charge of the United States Army Dental Corp in the South Pacific and his many friends in Australia will be pleased to hear of his recent appointment.

Navy Promotion

John Ellis Richards, O.B.E., R.A.N., Hon. Dental Surgeon to His Excellency the Governor-General, to be Surgeon Captain (D), 8/12/53.

Association Activities

Executive Report.

Fluoridation of Drinking Water.

Following consideration of the resolutions of the National Health and Medical Research Council at its meeting in December, 1953, the Executive decided to request the Minister for Health for New South Wales, the Hon. M. O'Sullivan, to receive a deputation concerning the implementation of the second resolution of the Council which recommended the establishment within each State Health Department of an advisory panel on fluoridation.

The Minister received this deputation on April 1. The deputation consisted of the President, Dr. F. E. Helmore and the Secretary, Dr. N. E. Goldsworthy of the Institute of Dental Research, and Mr. N. D. Martin, senior lecturer in preventive dentistry at the University of Sydney.

The deputation was well received by the Minister. He promised investigation of the means whereby such a panel could be established within his department.

Federal Office has advised that the Federal Council of the British Medical Association in Australia have considered the matter of fluoridation and have resolved to fully endorse the resolutions of the National Health and Medical Research Council.

Dental Technicians' Award.

Subsequent to a conference on March 23 between the parties to the award the matters still under debate were partly heard by the Dental Technicians' State Conciliation Committee on April 21 and a further meeting of this Committee was scheduled for May 5. The whole award is under review by the Committee.

Suburban Dental Organisations' Liaison Committee.

The Executive has considered recommendations from this Committee in the matter of possible affiliation of the various suburban dental organisations with the Association. Having decided that a basis upon which this affiliation could be achieved should be investigated, the matter has been referred to the appropriate committee of the Executive for their detailed examination and report.

The Executive believes the best interests of the profession as a whole will be served if every effort is made to ascertain the views of its members and to achieve the closest co-operation of effort to enable a unified approach to the problems affecting the profession.

Post-Graduate Courses in Pharmacology.

The Executive is pleased to report a most satisfactory response to the two Post-Graduate courses in Pharmacology. The evening course commenced on May 3 and the day course was held on May 24 and 25. The Association is indebted to Professor Thorp and the staff of the Department of Pharmacology of the University of Sydney for their co-operation in providing lecturers for the six lectures of each course. It is felt that considerable benefit will be obtained by those members fortunate enough to attend the course.

Membership.

Full members.

Cloutier, Roy Q. Michen, B.D.S., D.D.S. (Tor.); Cross, Robert B., B.D.S.; Dobson, Brian T., B.D.S.; Edwards, Bernard L., B.D.S.; Hebbard, David R., B.D.S.; Hey, Eric C., B.D.S.; Hudson, Reginald W., Jnr., B.D.S.; Nader, Barry A., B.D.S.; Nisbett, John A., B.D.S.; Rankin, Aubrey James, B.D.S.; Sebel, Abraham, B.D.S.; Wilson, David J., B.D.S.

Resumption of Full Membership.

Staples, W. L., B.D.S.

Qualified Membership.

Pyke, T. F., B.D.S.

Leave of Absence.

Dabbs, F. H. W.; S. J. Begg, B.D.S.

Student Associates.

Day, E. A.; Donaldson, R. G.; Downes, G. E.; Fitzsimons, J. R.; Hallett, C. R. M.; James, R. P.; Kringas, J. J.; Lawes, D. C. A.; MacGee, M. A.; Mackey, L.; McKay, W. R.; Nesbitt, K. F.; Pocock, J. C.; Rabey, G.; Stephen, B. W. H.; Watson, J. E.; Yule, A. J.

Abstracts of Current Literature

A short note on certain selected articles appearing in current overseas journals.

The New York Journal of Dentistry, Vol. 24, No. 2, March, 1954.

Concepts in Endodontics: Bender, I. B.

Three important fundamental requirements are stressed, namely, use of rubber dam, good mechanical cleansing and the obtaining of an hermetic seal of the root canal. The rubber dam is used to preserve a surgically clean technic and is expedient for executing the operation with more speed.

The author is in favour of using antibiotics to obtain sterility of the root canal.

A Sponge Rubber Chemical Sterilizer for Endodontic Instruments: Buchbinder, M.

A sponge rubber sterilizer is described whereby endodontic instruments can be thrust through the rubber containing Zephiran chloride and sodium nitrate. The instruments are automatically cleaned and prevented from rusting. A series of tests showed all instruments to be sterile within 30 minutes.

Root Canal Therapy for the Primary Teeth: Kelsten, L. B.

After making a careful selection of cases to be treated the author proceeds with a cleansing and sterilizing process. He advocates the use of Terramycin. No allergic reactions were seen and negative cultures were obtained, sometimes after one dressing.

International Dental Journal, Vol. 4, No. 2, December, 1953.

The Histological Changes in the Pulp of Teeth Filled with Self-Polimerizing Resins: Muller, O.

Changes from the normal have often been described in histological sections of the pulps of teeth in which self-curing resin restorations have been inserted. Changes were found in the pulp of 85 teeth examined and the destruction was considerably greater in cases where the cavity had not been lined.

The pulpal damage was partly of an inflammatory nature and partly degenerative. That part of the pulp closest to the cavity was the first to be affected. Leucocytic infiltration at times reaches such a degree that purulent degeneration results. Destruction of the odontoblastic layer also can occur.

The Dental Plaque in Relation to the Etiology of Caries: Stephan, R. M.

Dental plaques are found in both sound and carious tooth surfaces. Although no specific qualitative differences, either microscopic, bacteriological or biochemical have been established between them, some quantitative differences have been observed. In particular it has been noted that lower pH levels can be produced in plaques on carious teeth by the introduction of carbohydrates.

Treatment of Fractured Incisors: Ellis, R. G.

Maxillary central and lateral incisors in boys six to 12 years of age are the teeth most susceptible to injury. Their treatment must include not only restoration of the lost tooth structure but preservation of vitality of the pulp and the elimination of disfigurement.

A classification is presented as a guide to treatment planning. Treatment is discussed under three headings: emergency treatment, which provides protection for the pulp and periodontal tissues immediately after the accident and during a period of rest and recovery; intermediate treatment, when a temporary restoration is used and final treatment following on the development of mature dentine.

Psychology and Dentistry: Balters, W.

There is no sense organ more suitable to demonstrate psychological processes than the sense organ mouth. That is why we can regard dentistry as the most fortunate, the most varied, but also the most difficult branch of medicine, which forms a connecting link between man and his environment. There is no branch of dentistry that does not have the closest connection with psychology, in early childhood, in the art of education, in guidance in health and treatment in sickness.

New Books and Publications

PERIODONTIA, by H. M. Goldman, St. Louis, 1953, ed. 6. C. V. Mosby Company. (790 pp., 525 illus.). Price 168/- *Our copy by courtesy of W. Ramsay (Surgical) Pty. Ltd.*

This edition has been completely re-written and enlarged, new sections added, and it is profusely illustrated. The author says the re-writing has been necessary, not only because of the many changes in ideas concerning aetiology and pathogenesis of periodontal disease but also because of changes in therapy.

The first half of the book deals with periodontal anatomy and physiology, pathology, experimental pathology, aetiology, examination and diagnosis. In dealing with the experimental pathology the author makes it quite clear (as is not always done) that correlation between conditions seen in animals and human beings has not been definitely established. The author stresses too, that periodontal disease often presents a complex composite picture of many types of lesions co-existing with various causes operating in the same mouth. At the same time, the importance of local irritation is stressed and there is a full discussion of this aspect.

The author uses the terminology and classification of periodontal disease as laid down by the American Academy of Periodontology. A standard terminology is certainly needed, but I doubt if the Academy Classification is the best available. This section is a little disjointed and is not up to the general standard of the rest of the book.

The second half of the book deals with treatment (conservative and surgical), management of occlusion in periodontal therapy in all its phases, correction of faulty dentistry and construction of splints and prosthetic appliances. There are also special chapters on toothbrushing ("gingival physiotherapy"), necrotising ulcerative gingivitis (Vincent's infection) and gingival manifestations of systemic disease. The chapter on prophylaxis and instrumentation is particularly good, excellent photographs illustrating the very important positions and finger rests needed in carrying out these operations. I feel that subgingival curettage (whether to achieve re-attachment or merely shrinkage of the gingival tissue) is over emphasised in view of the fact (as the author makes quite clear) that the operation is difficult to perform and is so often contra-indicated.

Discussing necrotising ulcerative gingivitis (Vincent's infection) the author states that the concensus of opinion is that the disease is not communicable and that removal of calculus and debris should be carried out at the first visit. He points out, too, that while penicillin is very valuable in the acute phases of the disease, it does no more than bring about a temporary remission in the subacute and chronic condition and that other routine procedures of periodontal therapy must be carried out. This should help to dispel some of the misunderstandings and general uncertaincies associated with this disease.

The author continually stresses the value of oral hygiene in maintaining a healthy periodontium and sums it up in this sentence: "The ability and willingness of the patient to perform the exacting home care routine advised may often be the difference between success and failure in periodontal therapy."

This book can be recommended as a most thorough work and it would seem that no aspect of periodontia has been overlooked.

—*S.L.*

THE SCIENTIFICALLY DESIGNED PARTIAL VENEER THREE-QUARTER CROWN, by W. E. Jones, Minnesota, 1952. Burgess Publishing Co. (61 pp. illus.). *Our copy by courtesy of the publishers.*

This handsomely bound small book suffers an initial disadvantage in that the selection of the type for the text has made the reading of it somewhat a strain. As it is, we have a book of 61 pages devoted to a three-quarter veneer preparation using incisal and lateral grooves: for the most part it is cut in enamel and admits of no modification; the author neither suggests nor discusses any. He takes the opportunity, moreover, in his references to other authors, to chide them for their shortcomings in not realising the essential truths which he claims to reveal. Names such as Tylman, Doxtater and Klaffenbach are among those listed in the 35 references.

Dr. Jones has gone to some trouble to acquaint himself with the knowledge of the mechanics involved in three-quarter veneer preparations by consulting a professor of physics, but this was done after his ideas on such preparations had been published.

The presentation of Dr. Jones' subject as it pertains to the actual preparation of the tooth is quite adequately set out and illustrated. Other phases of the work are badly handled and in some ways bear little relationship to his concept of the term, "scientific," as for instance the sections on wax pattens, investing and casting and the types of alloys used for this purpose.

After reading this essay, no one can deny the author's sincerity, yet what he has said in a lot of words has been better and more concisely stated elsewhere. Perhaps with better judgment and his attitude less pinpointed, his effort might have been worthwhile.

—*N.W.K.*

Australian Dental Association

FEDERAL NEWSLETTER No. 12.

The Federal Executive of the Australian Dental Association met in Sydney on 27th March, 1954, when the following matters of general interest to the profession were dealt with.

Repatriation Dental Treatment.

Dr. Adamson, Vice-President, indicated that he had interviewed a senior officer of the Repatriation Commission concerning the necessity of medical approval before repatriation dental treatment was carried out and had been advised that the difficulty lies in the wording of the Regulations governing this treatment.

Dr. Adamson reported that he had been informed that as far as male personnel are concerned, their dental treatment must be regarded as part of their medical treatment and, therefore, is directly under the control of the medical officer who is treating the case. The medical officer decides whether the patient needs dental treatment and also the amount of dental treatment he may have. It is therefore obligatory that he shall sign a form before any dental treatment is rendered. Dr. Adamson reported, however, that war widows and war orphans receive dental treatment irrespective of medical treatment and that the Repatriation Commissioners have promised that in their case they would attempt to simplify procedure.

In order that State Branches might have the fullest information for reference, approval was given for the circulation of a comprehensive report outlining negotiations in connection with repatriation dental treatment from the first discussions for this plan in December, 1948, to date.

The lengthy period that these negotiations have occupied will indicate to members that public health problems are much more involved and complicated than is generally realised except by the negotiating representatives.

Fluoridation of Public Water Supplies.

It was agreed that a letter be forwarded to all State Branches drawing their attention to the recommendations of the National Health & Medical Research Council concerning the appointment of Advisory Panels within State Health Departments and requesting that each State Branch ensure that both the medical and dental professions are adequately represented on any Panel appointed.

A letter, dated 24th March, 1954, from the Federal Council of the British Medical Association in Australia, conveying the Council's endorsement of the resolutions of the National Health & Medical Research Council in regard to the fluoridation of drinking waters, was tabled and received.

Commonwealth Medical Benefits and Pharmaceutical Benefits.

It was noted that parts of the new Federal Health Act had not as yet been promulgated, as reported in the last Federal Newsletter. However, since the date of the meeting the promulgation has been made and these sections of the Act are now operative.

National Dental Journal.

A comprehensive memorandum concerning the establishment of this proposed Journal was considered in detail by the meeting. The meeting discussed at length the establishment of a suitable controlling Board, its constitution and duties.

Detailed consideration was given to the finance of the Journal and subscription rates.

It was decided that the memorandum should be amended in the light of the discussions at the meeting and that the amended memorandum be forwarded to all State Branches for their examination and comment.

Annual Meetings of the British Dental Association and the Federation Dentaire Internationale.

It was resolved that Dr. Draper Campbell, Dean of the Faculty of Dentistry be appointed the Association's representative to the Annual Meeting of the British Dental Association to be held at Blackpool on 10th May, 1954.

Dr. Draper Campbell has also been asked to act as observer for the Association at the annual meeting of the Federation Dentaire Internationale to be held at The Hague from 8th-13th June, 1954.

J. V. Hall Best,
Federal President.

Sydney.

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